



Montana Department of
ENVIRONMENTAL QUALITY

P.O. Box 200901 • Helena, MT 59620-0901 • (406) 444-2544 • www.deq.mt.gov

MAILED
5-27-11

Brian Schweitzer, Governor
Richard H. Opper, Director

May 26, 2011

Mr. Russell Huotari
2140 W. Holly Street
Sidney, MT 59270-5700

**RE: CLOSED RICHLAND COUNTY LANDFILL – LICENSE #102
MAY 2011 AMENDMENT TO SAMPLING AND ANALYSIS PLAN**

Dear Mr. Huotari:

The Solid Waste Program has reviewed the amendment to the Sampling and Analysis Plan for the closed Richland County Class II Landfill, License #102, in Sidney, Montana. The amendment is approved and will be included in our files.

If you have any questions or comments regarding this review, please contact me at the Permitting and Compliance Division, Waste and Underground Tank Management Bureau, Solid Waste Section.

Sincerely,

Martin Van Oort
Environmental Science Specialist
Solid Waste Program
Phone: 406-444-2802, Fax: 406-444-1374
E-mail: mvanoort@mt.gov

cc: Mr. Kelly Logan, Richland County Sanitarian, 1201 West Holly St., Suite 5, Sidney, MT 59270
Richland County Commissioners, 201 W Main, Sidney, MT 59270-4087

File: Closed\Richland Co.\Richland Co. Class II\License #102\Ground Water Reports
Path: G:\WUT\SWS\GWater\Responses\Richland Co\2011-05_richland_#102_SAP_amend.docx

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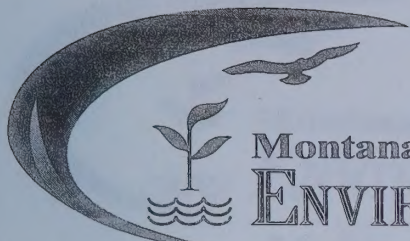
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2-1-11 JH

Brian Schweitzer, Governor
Richard H. Opper, Director

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February 1, 2011

Mr. Russell Huotari
2140 W. Holly Street
Sidney, MT 59270-5700

**RE: CLOSED RICHLAND COUNTY LANDFILL – LICENSE #102
OCTOBER 2010 SAMPLING REPORT
DECEMBER 2010 SAMPLING AND ANALYSIS PLAN**

Dear Mr. Huotari:

The Solid Waste Program (SWP) has reviewed the above noted reports for the closed Richland County Class II Landfill, License #102, in Sidney, Montana. The groundwater sampling report meets the requirements of the Administrative Rule of Montana (ARM) Title 17, Chapter 50, Subchapter 13.

The groundwater monitoring parameter list on the final page of the Sampling and Analysis Plan (SAP) was revised to reflect the changes approved by the SWP in our November 23, 2010 letter. The approved groundwater monitoring parameter list is as follows:

- | | | |
|-----------------------|--------------------------|-----------------------------------|
| • Barium(spring only) | • Selenium (spring only) | • Specific conductance |
| • Chloride | • Sulfate | • 40 CFR Part 258 Appendix I VOCs |
| • Nitrate + Nitrite | • pH | + Dichlorodifluoromethane |

With this revision the SAP is approved by the SWP and will be included in our files. Please use the procedures described in this document for all future sampling events.

If you have any questions or comments regarding this review, please contact me at the Permitting and Compliance Division, Waste and Underground Tank Management Bureau, Solid Waste Section.

Sincerely,

Martin Van Oort
Environmental Science Specialist
Solid Waste Program

Phone: 406-444-2802, Fax: 406-444-1374

E-mail: mvanoort@mt.gov

cc: Mr. Kelly Logan, Richland County Sanitarian, 1201 West Holly St., Suite 5, Sidney, MT 59270
Richland County Commissioners, 201 W Main, Sidney, MT 59270-4087

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Montana Department of
ENVIRONMENTAL QUALITY

MAILED

11-23-10 gh

Brian Schweitzer, Governor
Richard H. Opper, Director

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November 23, 2010

Mr. Russell Huotari
2140 W. Holly Street
Sidney, MT 59270-5700

RE: **CLOSED RICHLAND COUNTY LANDFILL – LICENSE #102**
JULY 2010 SAMPLING REPORT
REPORT OF INVESTIGATION AND MONITORING ACTIVITIES – JULY AND AUGUST 2010

Dear Mr. Huotari:

The Department has reviewed the above noted reports for the closed Richland County Class II Landfill, License #102, in Sidney, Montana. The initial data from the new wells, SL-10 through SL-15, indicate that the full lateral extent of the VOC plume north of the landfill has been delineated.

The data gathered during these investigations should be used to prepare a Corrective Measures Assessment (CMA) to evaluate potential remediation options for the groundwater VOC plume. Based on the decreasing low concentrations of methane detected during routine monitoring, the passive landfill gas venting system already in place appears to have been effective in controlling landfill gas at this site. However, this landfill gas remediation has not resulted in corresponding remediation of the groundwater plume. For this reason, the Department will not approve an active gas system as a further remedial option. A draft of the CMA should be submitted to the Department for review by February 21, 2011.

The sampling parameters and schedule presented in the report are acceptable with the following revisions:

- Well SL-14 does not need to be sampled at this time because well SL-11 will detect any VOCs first.
- Static water levels should continue to be measured in SL-14 and SL-15, if water is present.
- Selenium should continue to be analyzed annually in SL-1 through SL-4.

Please finalize the facility Sampling and Analysis Plan including these revisions and submit it to the Department by December 23, 2010.

If you have any questions or comments regarding this review, please contact me at the Permitting and Compliance Division, Waste and Underground Tank Management Bureau, Solid Waste Section.

Sincerely,

Martin Van Oort
Environmental Science Specialist
Solid Waste Program
Phone: 406-444-2802, Fax: 406-444-1374
E-mail: mvanoort@mt.gov

cc: Mr. Kelly Logan, Richland County Sanitarian, 1201 West Holly St., Suite 5, Sidney, MT 59270
Richland County Commissioners, 201 W Main, Sidney, MT 59270-4087
Mark F. Pearson, Tetra Tech, 851 Bridger Drive, Suite 6, Bozeman, MT 59715

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Date Requested: 11/17/10

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Date Needed By: 11/23/10

REVIEW
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Name

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Admin

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Mary H

Review

11/17/10

Darrell

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11-19

Rock

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11-22-10

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07-02-10 mfm



Montana Department of
ENVIRONMENTAL QUALITY

Brian Schweitzer, Governor
Richard H. Opper, Director

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July 1, 2010

Mr. Russell Huotari
2140 W. Holly Street
Sidney, MT 59270-5700

RE: **CLOSED RICHLAND COUNTY LANDFILL – LICENSE #102**
REPORT OF INVESTIGATION AND MONITORING ACTIVITIES – NOVEMBER & DECEMBER 2009
REPORT OF APRIL 2010 GROUNDWATER SAMPLING
MAY 2010 PROPOSAL FOR ADDITIONAL INVESTIGATION AND MONITORING ACTIVITIES

Dear Mr. Huotari:

The Department has reviewed the above noted reports for the closed Richland County Class II Landfill, License #102, in Sidney, Montana. The groundwater sampling report meets the requirements of the Administrative Rule of Montana (ARM) Title 17, Chapter 50, Subchapter 13 with the following exception:

- The rate of groundwater flow must be calculated each time a well is sampled as required in ARM 17.50.1305(5). The groundwater velocity is calculated using the formula: $v = k * i / n$ where, v is the velocity, k is the hydraulic conductivity, i is the groundwater gradient, and n is the effective porosity. The average hydraulic conductivity from the recent slug tests was 16.2 feet/day. A typical effective porosity for sand and gravel is 0.25. The gradient should be calculated after each sampling event by dividing the difference in water elevation in two wells by the distance between the wells. Using the gradients from well pairs SL-8/SL-7 and SL-4/SL-7 should give a reasonable range of gradients for the site. Please include a calculation of groundwater velocity in future groundwater sampling reports.

Thank you for including the data from the additional spring and residential well north of the landfill. The results show that these locations have not been impacted by the VOC plume emanating from the landfill. Because of its location nearer to the landfill, Almond's spring may be a better location to include in the semi-annual sampling instead of spring S-3.

The facility remains in corrective action with semi-annual monitoring at this time. As requested in the May 2010 proposal, future groundwater sampling events for this facility may include analysis for VOCs only at all of the new wells, SL-6 through SL-9 and the wells proposed to be installed in 2010. Wells SL-1 through SL-4, as the point of compliance wells for the facility, must continue to be sampled for the full Department approved analyte list. If the facility wishes to reduce the analyte list for the point of compliance wells, a formal request, with justification for the proposed reductions, must be submitted to the Department in writing.

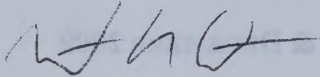
Regarding the work plan for additional investigations, the department approves the plan with the following condition:

- Because PCE concentrations in both wells SL-3 and SL-9 are above the MCL, at least one well should be installed west of SL-9 to define the western boundary of contamination.

The additional sampling planned for July 2010 does not need to include well SL-5, because VOC concentrations have typically been low at this well.

If you have any questions or comments regarding this review, please contact me at the Permitting and Compliance Division, Waste and Underground Tank Management Bureau, Solid Waste Section.

Sincerely,



Martin Van Oort
Environmental Science Specialist
Solid Waste Program

Phone: 406-444-2802, Fax: 406-444-1374

E-mail: mvanoort@mt.gov

cc: Mr. Kelly Logan, Richland County Sanitarian, 1201 West Holly St., Suite 5, Sidney, MT 59270
Richland County Commissioners, 201 W Main, Sidney, MT 59270-4087
Mark F. Pearson, Tetra Tech, 851 Bridger Drive, Suite 6, Bozeman, MT 59715

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MAILED
4-29-10 Jh

Brian Schweitzer, Governor
Richard H. Opper, Director

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April 27, 2010

Mr. Russell Huotari
2140 W. Holly Street
Sidney, MT 59270-5700

RE: **CLOSED RICHLAND COUNTY LANDFILL – LICENSE #102
NOVEMBER 2009 GROUNDWATER MONITORING WELL LOGS**

Dear Mr. Huotari:

The Department has received the logs for the groundwater monitoring wells installed in November 2009 at the closed Richland County Class II Landfill, License #102, in Sidney, Montana. Thank you for submitting the well logs, they will be included in our files.

If you have any questions or comments, please contact me at the Permitting and Compliance Division, Waste and Underground Tank Management Bureau, Solid Waste Section.

Sincerely,

Martin Van Oort
Environmental Science Specialist
Solid Waste Program
Phone: 406-444-2802, Fax: 406-444-1374
E-mail: mvanoort@mt.gov

cc: Mr. Kelly Logan, Richland County Sanitarian, 1201 West Holly St., Suite 5, Sidney, MT 59270
Richland County Commissioners, 201 W Main, Sidney, MT 59270-4087
Mark Pearson, Tetra Tech, 851 Bridger Drive, Suite F, Bozeman, MT 59715

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County Richland
Facility & # Richland Co #102
Closure _____
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GW Monitoring _____
GW Reports _____
Inspections _____
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RICHLAND COUNTY LANDFILL #102

SAMPLING AND ANALYSIS PLAN

December 3, 2010

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WATER & LAND USE
DIVISION
SOUTH CAROLINA
DEPARTMENT OF
NATURAL RESOURCES

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DEC 14 2010

Dept. of Enviro. Quality
Waste & Underground
Tank Management Bureau

Sampling and Analysis Plan for

Sidney Landfill #102

December 3, 2010

The Montana Department of Environmental Quality has requested an updated Sampling and Analysis Plan for the Sidney Landfill # 102 to meet the requirements of ARM 17.50.708. This facility remains in the corrective measure phase of groundwater monitoring with tetrachloroethene being over the maximum contaminant level in two point of compliance wells (SL-3 and SL-4) and monitoring wells SL-6 thru SL-9. Samples are to be collected twice per year, at least three months apart, at high and low groundwater periods during the post-closure care period unless specified otherwise by DEQ. Samples will normally be collected in April/May and in September/October. DEQ will be notified in advance to allow the department the opportunity to take spilt samples. Samples will be collected according to the following table.

Sampling site	Collected in spring and fall	Collected in spring only
S-5, SL-1 thru SL-13	VOC's; field parameters	
S-5, SL-1 thru SL-4	inorganics	
SL-1 thru SL-4		Barium, selenium
Almond's spring, Lamphier's well	Field parameters	

Location of the monitoring sites and access to the sites are shown on the enclosed photo. Samples are to be collected by Kelly Logan, R.S. of the Richland County Health Department.

Sampling Equipment and Procedure

- Keys to the monitoring wells are available at the Sanitarians office located at 1201 West Holly Suite #5 and at the Office of Public Works located at 2140 West Holly Street.
- All monitoring wells will be purged of at least three well casing volumes of water prior to sampling using a disposable polyethylene bailer. Water samples will be transferred directly to the appropriate containers to minimize air entrapment with VOC samples being collected first.
- Metal samples will be filtered in the field using a 0.45 micron filter.
- Prior to purging, the depth to water will be measured in each monitoring well (SL-1 thru SL-15) to the nearest 0.01 foot and recorded on the groundwater sampling log. Measurements will be taken with a decontaminated electric well probe. Measurements will be taken on the north side or from a designated spot on top of the well casing in sufficiently short time to avoid temporal variations.
- Field measurements will be recorded for pH, temperature, and conductivity on the groundwater sampling log.
- Grab samples will be taken from spring S-5 and Almond's spring near the discharge pipe or the point of issuance. Lamphier's well will be sampled from the hydrant adjacent to the well.

QA/QC Samples

- A duplicate sample will be collected and analyzed for all parameters.
- Trip blank samples will be prepared by the laboratory and will be stored with the sample containers/samples and will be analyzed for volatile organic compounds.

Sample Handling and Analysis

- Samples will be analyzed by Energy Laboratories, Inc. Billings, MT using EPA approved methods.
- Samples will be shipped via UPS using “Chain of Custody and Analytical Request Record” forms furnished by the laboratory. Samples will be packaged following the laboratory recommendations to maintain sample temperatures.
- Field and laboratory data are required to be submitted to DEQ within 90 days of the completion of the monitoring event. Reporting limits and QA/QC Summary Reports are included.
- Field meters will be calibrated following manufacturers instructions on a daily basis or as required.
- See Sampling and Analysis Plan for Richland County Landfill #376, July 2010 for details on the laboratory and meters used.

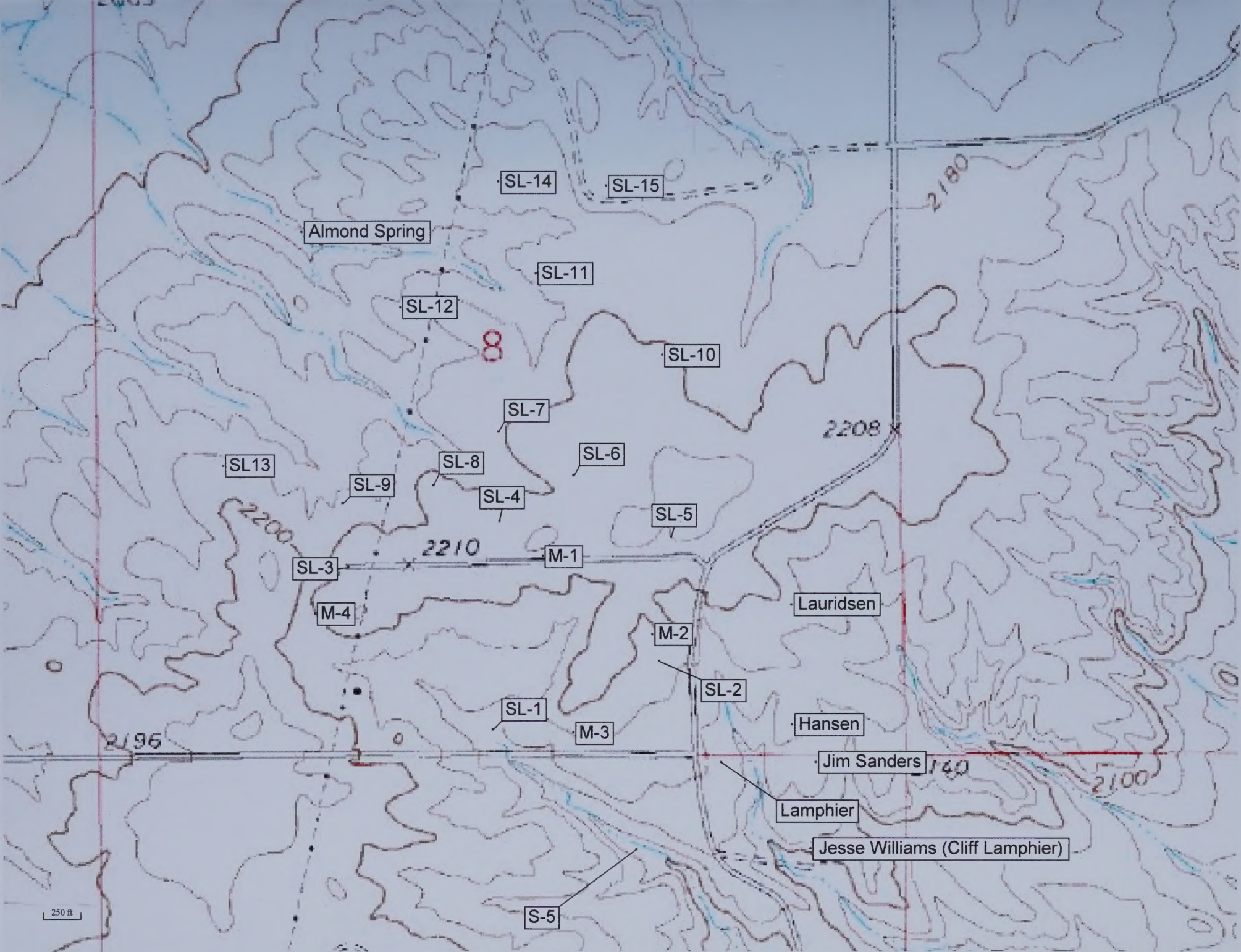
Data Evaluation

- Spring S-5, spring S-3, Almond’s spring, and monitoring wells SL-5, SL-10 thru SL-14 will help establish background information on the uppermost water bearing unit beneath the landfill. S-3 appears to discharge from a coal seam and S-5 appears to discharge from the base of gravel deposits.
- Linear least-squares trend analysis has been determined adequate by DEQ for evaluating corrective action and shall be performed for every parameter that exceeds groundwater protection standards.

Supplies

pH meter & two 50ml beakers	Scissors	Thermometer
buffers ph 7 and pH 9	Garbage sack	Vacuum pump and filters (.45)
Kimwipes/paper towels	Bailers and nylon rope	Clip board
2 - C batteries; 2 – AA batteries	2 – two gallon waste buckets	500 ml squeeze bottles
100 ml graduated cylinder	Disposable gloves	Water level meter
Conductivity meter	Storage containers and straps	Log sheets, site map, SAP
standard 1413 uS/cm	Ice/ice chests	Sample containers, preservative
pH electrode storage solution	Zip lock bags	Calculator/ stop watch
Alconox	Felt tip markers	Distilled water
Distilled water	scissors	Keys to landfill





GROUNDWATER SAMPLING LOG - RICHLAND COUNTY LANDFILL NO. _____

DATE/TIME _____ / _____ STATION _____

WEATHER _____ WIND _____ @ _____ MPH

CASING TYPE _____ CASING DIAMETER _____ CASING STICKUP _____

MEASURING PT. _____ DEPTH TO WATER _____ TOTAL DEPTH _____

WELL EXCAVATION _____ DISPOSABLE BAILER _____ OTHER _____

ONE CASING VOLUME = _____ GALLONS X 3 = _____ GALLONS

COMMENTS _____

TIME	CUMULATIVE GALLONS	TEMPERATURE	pH	SPECIFIC CONDUCTANCE

<u>SAMPLE</u>	NATURAL	DUPLICATE	X-CONTAM.	TRIP BLANK	BLIND
_____ 3 – 40 ML VOA		VOC	HCL		
_____ 1 – 250 ML PLASTIC		NUTRIENTS	H ₂ SO ₄		
_____ 1 – 500 ML PLASTIC		COMMON IONS	NONE		
_____ 1 – 250 ML PLASTIC		METALS	FILTERED - HNO ₃		
_____ 1 – 250 ML PLASTIC		CYANIDE	NAOH		

DECONTAMINATION SCRUB - LIQUINOX - D.I. H₂O - NITRIC ACID - METHANOL

COMMENTS _____

TABLE 1 - GROUND WATER MONITORING PARAMETERS

~~1. Antimony~~	14. Nitrate (as N)
~~2. Arsenic~~	~~15. Nickel~~
3. Barium	16. Selenium
~~4. Beryllium~~	~~17. Silver~~
~~5. Cadmium~~	18. Sulfate (SO ₄)
6. Chloride	~~19. Thallium~~
~~7. Chromium~~	~~20. Vanadium~~
~~8. Cobalt~~	~~21. Zinc~~
~~9. Copper~~	~~22. Chemical Oxygen Demand~~
~~10. Cyanide~~	~~(COD)~~
~~11. Iron~~	23. pH
~~12. Lead~~	24. Specific conductance
~~13. Mercury~~	

25. The following volatile organic compounds (VOCs by EPA method 8260):

- Acetone
- Acrylonitrile
- Benzene
- Bromochloromethane
- Bromodichloromethane
- Bromoform
- Carbon disulfide
- Carbon tetrachloride
- Chlorobenzene
- Chloroethane
- Chloroform
- Chlorodibromomethane
- 1,2-Dibromo-3-chloropropane (DBCP)
- 1,2-Dibromoethane; (EDB)
- o-Dichlorobenzene; 1,2-Di-chlorobenzene
- p-Dichlorobenzene; 1,4-Di-chlorobenzene
- trans-1,4-Dichloro-2-butene
- 1,1-Dichloroethane
- 1,2-Dichloroethane
- 1,1-Dichloroethylene
- cis-1,2-Dichloroethylene
- trans-1,2-Dichloroethylene
- 1,2-Dichloropropane
- cis-1,3-Dichloropropene
- trans-1,3-Dichloropropene
- Ethylbenzene
- 2-Hexanone; Methyl butyl ketone
- Methyl bromide;
- Bromometh-ane
- Methyl chloride; Chloro-methane
- Methylene bromide;
- Dibro-momethane
- Methylene chloride
- Methyl ethyl ketone; MEK
- Methyl iodide;
- Iodomethane
- 4-Methyl-2-pentanone; Meth-yl isobutyl ketone
- Styrene
- 1,1,1,2-Tetrachloroethane
- 1,1,2,2-Tetrachloroethane
- Tetrachloroethylene
- Toluene
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- Trichloroethene
- Trichlorofluoromethane
- 1,2,3-Trichloropropane
- Vinyl acetate
- Vinyl chloride
- Xylenes
- Dichlorodifluoromethane



TETRA TECH, INC.

May 14, 2010

Mr. Kelly Logan and Mr. Russell Houtari
Richland County
2140 West Holly Street
Sidney, MT 59270

**RE: Report of Investigation and Monitoring Activities – November and December 2009
Richland County Former Landfill #102
Sidney, Richland County, Montana**

Dear Gentlemen:

Enclosed is a report summarizing the results of Tetra Tech's investigation and monitoring activities conducted in November 2009. Some discussion of the results of Richland County's December 2009 monitoring is also included. This report can serve as a basis for additional investigations or evaluations, as needed.

Please call with any questions or comments. Following any edits to this document and approval from you, we can forward this to Martin VanOort, case manager, Montana Department of Environmental Quality. We appreciate the opportunity to work with Richland County on this project.

Sincerely,

Mark F. Pearson
Project Hydrogeologist

Enclosure: Report of Investigation and Monitoring Activities – November and December 2009

Closed
County Richland
Facility & # Richland Co #102
Closure Landfarm
Finan Assur Liner
GW Corr Meas Methane
GW Monitoring O & M
GW Reports Run-on
Inspections
Other: _____

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JUN 01 2010

DEPT. OF ENVIRO. QUALITY
WASTE & UNDERGROUND TANK
MANAGEMENT BUREAU

851 Bridger Drive, Suite 6 (59715)
P.O. Box 1413 (59771)
Bozeman, MT
Office 406.582.8780
Fax 406.582.8790

Report of Investigation and Monitoring Activities – November and December 2009

**Richland County Former Landfill #102
Sidney, Richland County, Montana**

Report of Investigation and Monitoring Activities – November and December 2009

**Richland County Former Landfill #102
Sidney, Richland County, Montana**

Submitted to:

**Mr. Kelly Logan and Mr. Russell Houtari
Richland County
2140 West Holly Street
Sidney, MT 59270**

Submitted by:

**Tetra Tech, Inc.
851 Bridger Drive, Ste 6
Bozeman, Montana 59715**

May 14, 2010

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LIST OF APPENDICES**APPENDIX A: FIGURES**

- FIGURE 1 Location Map
- FIGURE 2 Site Vicinity
- FIGURE 3 Groundwater Contour Map
- FIGURE 4 Tetrachloroethene in Monitoring Wells

APPENDIX B: TABLES

- TABLE 1 Summary of Lithology and Monitoring Well Specifications
- TABLE 2 Summary of Results of Aquifer Slug Tests
- TABLE 3 Calculation of Groundwater Velocity and Estimate of Plume Travel
- TABLE 4 Summary of Selected Chlorinated Solvent Compound Concentrations
- TABLE 5 Summary of Selected Inorganic Constituent Concentrations

APPENDIX C: Drilling Logs**APPENDIX D: Aquifer Slug Tests Calculations**

1.0 INTRODUCTION

This document presents methods and results of Tetra Tech's groundwater investigations and monitoring activities for Richland County in November 2009 at the former Richland County Landfill #102 (site, **Figure 1**). Some of Richland County's monitoring results in December 2009 are also included with regard to the new monitoring wells and to complement an overall understanding of the site. Figures and tables are contained in **Appendix A** and **B**, respectively. Tetra Tech personnel conducted the groundwater investigations and Richland County personnel conducted the groundwater monitoring. The groundwater investigations were conducted in accordance with Tetra Tech's *Change Order to Investigation and Monitoring Work Plan dated August 7, 2010*. The change order was approved by Richland County on August 14, 2009.

The November 2009 groundwater investigations included drilling and completion of four monitoring wells north of the former landfill and aquifer tests. Groundwater monitoring activities included the measurement of water levels, field parameters, and sampling of site monitoring wells. The results of groundwater monitoring activities have already been reported to the Department of Environmental Quality by Richland County personnel. Richland County personnel sampled the monitoring wells and submitted the samples for laboratory analysis of volatile organic compounds (VOCs) and inorganic parameters, including metals.

1.1 BACKGROUND INFORMATION

The site is located on an 80 acre parcel about three miles north of Sidney, Montana (**Figure 1**). The site is in the south half of Section 8, Township 23 North, and Range 59 East, Richland County, Montana.

Topography

The site is located on an upland terrace approximately 250 feet above and northwest of the Yellowstone River valley at an average elevation of 1,990 feet above mean sea level (AMSL). Topography in the site vicinity suggests that the landfill is situated on the south aspect of a northeast trending drainage divide. Site topography generally slopes to the southeast with a total relief at the site of approximately 70 feet. The general layout of the site and vicinity is shown in **Figure 2**.

Climate

Climate of the site is characterized long, cold winters and short, cool summers. The average annual temperature at Sidney, three miles south of the site is 42 degrees Fahrenheit. Average annual precipitation is 14 inches and the average annual evaporation is approximately 33 inches.

Subsurface Soil and Unconsolidated Sediments

Unconsolidated deposits of gravel, sand, silt, and clay underlie the land surface in the site vicinity. These deposits mantle most of the bench land northwest of the Yellowstone River and have been removed by erosion in incised drainages. These unconsolidated deposits or sediments are defined as glacial outwash (John Reiten, Montana Bureau of Mines and Geology, personal communication, April 2010) and have also been classified as Quaternary glacial till (Qgt; Montana Bureau of Mines and Geology 2003). Monitoring well logs for SL-1 through SL-5 at the

site indicate that the glacial till varies in thickness between 30 (in well SL-1) and 94 feet (in well SL-5). Moving from wells SL-1 to SL-4 and SL-5 (northward) there is an increase in thickness of the glacial till. Glacial till consisting of sand and gravel has been mapped within the landfill boundaries where trenching to 41 feet depth has revealed sandy material with occasional one foot thick gravel zones. Hydraulic conductivities measured in the glacial till, near the surface, averaged 4×10^{-3} centimeters per second (Chen-Northern 1990).

Bedrock Formations and Structure

Bedrock underlying the glacial till in the site vicinity is comprised of Tongue River Member of Fort Union Formation (Tftr; Montana Bureau of Mines and Geology 2003). The Fort Union is visually distinct in the site vicinity, being gray shale in contrast to the tan glacial till, sand, and gravel deposits.

The Fort Union can consist of more than 1,000 feet of sandstone, shale, coal, clay, and clinker beds. Regionally, the formation is nearly horizontal, with a dip of 0.3% to the northeast (Montana Bureau of Mines and Geology 2003). In the site vicinity, the Fort Union has been mapped north and south of the site and appears to be exposed in bluffs and valley slopes.

In site monitoring wells, intersection of the Fort Union was as visually distinct, blue-gray, plastic, or sticky clay. Examination of elevations of the Fort Union intersection in wells SL-1 through SL-5 suggests a one percent (1%) northerly dip. The Fort Union intersection with the highest elevation is in well SL-1 (1,932 feet AMSL) and lowest elevations in wells SL-3 and SL-4 (1,917 and 1,919 feet AMSL, **Table 1**).

Hydrogeology

Hydrologic features in the vicinity of the site include the Yellowstone River located three miles to the southeast, Lone Tree Creek located three miles to the south, and several unnamed ephemeral creeks and springs. The Yellowstone Project irrigation canal is located approximately one mile southeast of the site (**Figure 1**).

Two distinct water bearing units exist in the site vicinity. The first water bearing unit is a relatively shallow water bearing unit that exists in the lower portion of the glacial sediments, perched on top of the Fort Union formation. This water bearing unit has been described as the "upper" or "perched" water bearing unit. Site monitoring data indicates that the saturated thickness of this unit is between three and 16 feet (**Table 1**).

The second water bearing unit is actually multiple water bearing units within the underlying Fort Union formation. Water bearing units in the Fort Union formation are sandstone, coal and clinker beds. The majority of the water supply wells in the vicinity of the old landfill are completed in the Fort Union formation, 100 feet or greater below ground surface, have static water levels 20 to 250 feet below ground surface, and yield between two and 20 gallons per minute (Montana Bureau of Mines GWIC 2010). Published, regional groundwater potentiometric contours/flow directions indicate groundwater flow in the Fort Union aquifer is to the southeast (USGS 1984).

Three springs, S-3, S-5, and Almond Spring have been included in the landfill's groundwater monitoring program and are located within one mile of the site (**Figure 2**). Spring S-3 discharges from a coal seam, approximately one mile north of the site, at a rate of

approximately 10 gallons per minute (gpm). Spring S-5 discharges from the base of gravel deposits, about 800 feet southeast of the site, at a rate of 1 to 2 gallons per minute. Almond Spring has an estimated discharge of one gallon per minute (Kelly Logan, Richland County Sanitarian, personal communication, May 2010).

Groundwater flow direction had been difficult to calculate between wells SL-1 through SL-5 due to the wells' spacing and inconsistency of groundwater elevations between wells. There is approximately two feet of groundwater elevation difference between the wells. One interpretation of the data suggests the existence of a groundwater divide trending northeast-southwest, within the landfill boundaries. Groundwater level monitoring has indicated that groundwater southeast of this divide could flow to the southeast and groundwater northwest of this divide could flow to the north or northwest at the site.

Domestic and Stockwater Wells

Domestic and stock water supply wells within a two mile radius of the site indicate that most of the wells are completed in the Fort Union formation, although there are wells completed in the unconsolidated glacial and terrace deposits, as well. The Montana Bureau of Mines Groundwater Information Center (GWIC) database indicates that there are eight domestic and water supply wells within a half mile and are in an east and southeast direction of the site. Domestic/water supply wells are located at the residences shown in **Figure 2**.

Land Use

Land use is primarily livestock grazing and farming. Property to the east and southeast of the site is rural residential. Six occupied residences are located within one-half mile of the site to the east and southeast.

Historic Landfill Operations

Landfill operations began at the site in 1970 and ceased in October 1995. The City of Sidney operated the landfill between 1970 and 1981. Richland County assumed operations after 1981. Previous reporting of the site indicated that landfill operations were conducted with little planning and no record keeping of where waste was placed over time (Damschen & Associates 1990).

In 1985, the Richland County excavated the first of two deeper waste cells and began landfilling refuse in the Deep Cells area (location is shown in **Figure 2**). This area consists of two large trenches where each was approximately 225 feet wide in an east-west dimension and 550 feet in a north-south dimension. The first cell was excavated, in the west half of the Deep Cells area, to a depth of approximately 40 feet, and filled with refuse. Groundwater was intercepted at the south margin of this cell. Therefore, the second cell was excavated to 25 feet depth to avoid interception with groundwater. The second cell was located in the east half of the Deep Cells area, parallel to the first cell. Refuse was accepted into the Deep Cells area until 1995.

Closure activities were conducted between 1993 and 1996. DEQ required that the entire landfill property be capped as part of closure operations. Clayey soil was excavated from a 40 acre area north of SL-3 and west of SL-4 to be used as a cap over the landfilled refuse. This clayey material was spread over the entire landfill property to a thickness of approximately two feet (Kelly Logan, Richland County Sanitarian, personal communication, May 2010). The eastern two thirds of the landfill was capped in 1993 and the western edge (one sixth) of the landfill was capped in 1994.

(Richland County, 2009). The Deep Cells area was capped in 1995. Closure activities also included recontouring (prior to capping) and revegetation. Closure activities were completed in 1996.

Monitoring and Corrective Measures Activities

Environmental monitoring of the landfill began in 1990 and a second monitoring event was conducted in 1991. Additional groundwater monitoring events were conducted through 1995 and indicated concentrations of volatile organic compounds (VOCs) exceeding groundwater protection standards (GPS). Analysis of this data in consideration of the Administrative Rules of Montana (Title 17, Chapter, 50, Subchapter 7) indicated that the preparation of a corrective measures assessment (CMA) was necessary. The CMA was completed in 1996 (Maxim Technologies 1996).

Richland County selected a no action alternative in the CMA but this alternative was not approved by Montana Department of Environmental Quality (DEQ). Therefore, the county decided to install a passive venting system to mitigate subsurface accumulation of landfill gas and infiltration of waste leachate containing VOCs to the groundwater. The passive venting system (also referred to as the passive methane extraction system) was approved by DEQ in 2000 and installed during November 2001 (Kelly Logan, Richland County Sanitarian, personal communication, May 2009).

The system has been installed in the Deep Cells area and another deeper cell area to the south, as shown in **Figure 2**. The venting systems consists of a horizontally buried network of 6-inch diameter, polyvinyl chloride (PVC) perforated piping with 10 PVC blank (casing) vertical pipes fitted with wind turbine ventilators. The extent of the piping network is approximately 350 feet in an east-west dimension and 450 feet in a north-south dimension, centered over the Deep Cells. The horizontal piping is approximately two feet below the ground surface. There has been no history of gas monitoring of the system in terms of air flow velocities, VOC, methane, oxygen, carbon dioxide concentrations, etc., to determine effectiveness/performance of the system.

The network of groundwater monitoring wells (before drilling and installation of wells SL-6 through SL-9 described in this report) is shown in **Figure 2**. The first three monitoring wells, SL-1 through SL-3 were installed in 1990. In 1994, an additional two monitoring wells, SL-4 and SL-5, were installed to better delineate the extent of VOCs in groundwater in the perceived downgradient direction of the landfill. VOCs were detected in well SL-4 but not SL-5. The groundwater and surface water monitoring program has included the sampling of a 25 foot deep, hand-dug water supply well on the Lamphier property east of the landfill, two springs (S-3 and S-5), and the five monitoring wells (SL-1 through SL-5).

Monitoring is conducted on a semi-annual basis for parameters listed in Table 1 of ARM 17.50.708. Recent monitoring data indicates impacts from VOCs in all of the wells except SL-5. Samples collected from wells SL-3 and SL-4 during monitoring events exhibit concentrations of tetrachloroethene that exceed enforcement standards. Other VOCs detected in well SL-3 include chloroform; 1,1-dichloroethane; cis-1,2-dichloroethene; trichloroethene; and dichlorodifluoromethane (Freon-11). Wells SL-1 and SL-2 exhibited concentrations of cis-1,2-dichloroethene, chloroform, and tetrachloroethene. Apart from VOCs exceeding regulatory standards, concentrations of barium in well SL-3 and nitrate+nitrite in wells SL-1 and SL-4 have exceeded regulatory standards.

Methane Monitoring

Methane monitoring is conducted on a quarterly basis from all of the monitoring wells and four methane monitoring wells (designated LG-1 through LG-4 in **(Figure 2)**) within the boundary of the landfill. The methane monitoring wells were drilled between 20 and 25 feet depth. Monitoring results show that only well SL-1 has measurable concentrations of methane which was initially 100% in 1995 and decreasing to 34 percent in September 2008.

1.2 INVESTIGATION AND MONITORING METHODS

This section describes methods used to drill and install the monitoring wells, conduct the aquifer slug tests, and monitor groundwater at the site. Results of these activities are presented in Section 2.0. Figures and tables are contained in **Appendix A** and **B**, respectively. Well logs are contained in **Appendix C**. Aquifer slug test calculations are contained in **Appendix D**.

1.2.1 Monitoring Well Installation

Four boreholes, SL-6 through SL-9, were advanced and completed as monitoring wells north of the northern landfill boundary (**Figure 2**) using H & H Drilling based in Glendive, Montana. H & H Drilling used a Chicago Pneumatic CP-650 tophead air rotary drilling rig with a casing advance system. The casing advance system drove steel casing down behind the rotary drill bit thereby preventing the borehole from collapsing. The drilling was conducted using compressed air to push the cuttings out of the hole.

Monitoring wells were completed with 2-inch diameter, Schedule 40 PVC blank and machine-slotted piping (0.020-inch slot size) with threaded joints. A PVC threaded, end-point was placed at the end of the PVC slotted piping of each well. Filter pack around the well screen consisted of 10/20 silica sand. The borehole around the PVC casing, above the screen, was filled with 3/8 inch bentonite chips to within a couple feet of the surface. Wells were finished as a stickup completion and have locking, steel, well protectors secured with concrete grout. Finally, the new monitoring wells were developed with an electric submersible pump.

1.2.2 Aquifer Tests

Tetra Tech conducted aquifer testing on the monitor wells at the Richland County Old Landfill to determine the hydraulic conductivity (permeability) of the aquifer. Slug testing was the selected method of aquifer testing. The slug test provides a very local estimate of the hydraulic conductivity in the near vicinity of the well.

Slug testing consists of measuring the static water level in the well, introducing a near instantaneous change in water level, and measuring the change in water level over time until the water level returns to the original static water level. The instantaneous change is conducted by adding and removing a solid cylinder (slug), of known volume, into/out of the cased well water column. The solid slug was constructed of 1.5-inch diameter PVC pipe, eight feet in length, and sealed at each end. The water level change was measured using a pressure transducer recording at selected time intervals with a computer data logger. The time interval was two or five seconds depending on the monitor well water level recovery response.

This testing was performed on the wells SL-2 through SL-7 and SL-9 (**Figure 2**). There was an insufficient water column in wells SL-1 and SL-8 (less than two feet) to successfully conduct the

testing. Slug testing was performed twice on each well, one test for the slug added in and one test for the slug removed.

The slug test water level data was analyzed using U.S. Geological Survey software developed for aquifer testing analyses (Halford and Kuniandy 2002). The slug testing software uses the Bouwer and Rice method (1976) for determining hydraulic conductivity. Aquifer slug test calculations are contained in **Appendix D**.

1.2.3 Groundwater Monitoring

Groundwater monitoring data used in this report was collected by Richland County personnel in December 2009. Monitoring is conducted semi-annually and as in previous monitoring events the December 2009 data was reviewed, compiled, and reported to DEQ by Richland County personnel. General procedures at each monitoring well were to measure depth to groundwater followed by purging of the well using a disposable bailer. A sample was collected for laboratory analysis after three well casing volumes had been purged. Portions of the sample were preserved and filtered.

2.0 DATA PRESENTATION AND ANALYSIS

Additional site information was obtained through the drilling and completion of four monitoring wells north of the landfill during November 2009 and the inclusion of these wells in the groundwater monitoring event that occurred during December 2009. Figures and tables are contained in **Appendix A** and **B**, respectively. Data presented in the foregoing sections summarizes aspects of site geology, groundwater occurrence and movement, and groundwater quality with respect to chlorinated solvent concentrations, specifically tetrachloroethene (also referred to as PCE). The data presentation and analysis presented here pertains to the northern portion of the landfill and north of the landfill where the four new monitoring wells are located. **Figure 2** shows the location of all groundwater monitoring wells at the site.

2.1 SITE GEOLOGY

Aspects of site geology were complemented in the drilling of wells SL-6 through SL-9 in terms of the thickness and lithologic character of the glacial till and top of Fort Union Formation and its apparent dip. Wells SL-6 through SL-9 were drilled through 84 to 45 feet of glacial till. The greatest thickness of glacial till intercepted has been in wells SL-3 through SL-6, between 84 and 93 feet thickness (**Table 1**). Wells SL-3 through SL-6 also have the highest ground surface elevations as these wells are located on a topographic high that slopes down to the northwest and southeast.

The glacial till intercepted in the drilling consists of sandy clay, clay, sand, and gravel. No organic material was observed in the cuttings. Gravel was encountered in the final five to 20 feet of drilling through glacial till before interception of the Fort Union Formation. The Fort Union was visually distinct and identified as gray shale intercepted in wells SL-6 through SL-9. No staining or unusual odors were detected while logging drill cuttings of these wells. Drilling logs of wells SL-6 through SL-9 are contained in **Appendix C**.

Elevation of the contact of Fort Union with glacial till in wells SL-5 through SL-9 was between 1,921 and 1,932 feet above mean sea level (AMSL). Elevation of the contact of Fort Union with glacial till in wells SL-3 and SL-4 are 1,917 and 1,919 feet AMSL. These spatial elevation

differences suggest that the contact of Fort Union with glacial till dips generally south between 0.3 and 3.4%.

2.2 GROUNDWATER OCCURRENCE AND MOVEMENT

Depth to groundwater and groundwater elevations are shown in **Table 1** for monitoring conducted on December 16, 2009. Richland County submitted a monitoring report and groundwater contour map using groundwater elevations measured on November 19, 2009. Richland County's report indicates that the measured variation of groundwater levels in wells SL-1 through SL-5 in 2009 was zero to 1.2 feet. Well SL-1 exhibited the greatest variation (1.2 feet) and the average of wells SL-2 through SL-5 for 2009 was 0.05 feet.

Measurement of depth to groundwater in wells SL-6 through SL-9 together with wells SL-3 through SL-5 has allowed for the preparation of a detailed groundwater contour map in the north part of the landfill and site vicinity. Richland County prepared this map and included it in their report to DEQ in January 2010 (Richland County 2010). A reproduction of their map is presented in **Figure 3**. The groundwater contour map indicates that groundwater in the northern part of the site appears to flow from the area of the Deep Cells towards well SL-4 and then turn in a northerly direction towards well SL-7 (Richland County 2010). The groundwater contours in Richland County's 2010 monitoring report imply a variation in gradient that could be calculated as a flow path between wells SL-4 and SL-7 and a flow path between wells SL-8 and SL-7. The slope of the groundwater table along a flow path between wells SL-4 and SL-7 is 0.72 feet in approximately 1,200 feet or 0.0006 feet per foot or 0.06%. The slope of the groundwater table along a flow path between wells SL-8 and SL-7 is 0.113 feet in approximately 562 feet or 0.002 feet per foot or 0.2%. The Richland County 2010 monitoring report also indicated an easterly groundwater flow between wells SL-1 and SL-2 (southern part of the landfill) under a slope or gradient of 0.17%.

Aquifer slug tests were performed on all of the monitoring wells except wells SL-1 and SL-8 in November 2009. The hydraulic conductivities based on aquifer slug testing are presented in **Table 2** and calculations are shown in **Appendix D**. Calculated hydraulic conductivities were between 0.27 and 57 feet per day. This is a relatively wide range of hydraulic conductivity values and may suggest the heterogeneous nature of the glacial till proximal to the Fort Union contact. For the northern vicinity of the site including wells SL-3 through SL-9, the average of all calculated hydraulic conductivities was 13.7 feet per day. The median of all calculated hydraulic conductivities was 5.8 feet per day.

Groundwater velocity and travel of the contaminant plume was calculated using parameters shown in **Table 3**. Given the range of parameters provided, groundwater velocity ranges between 0.01 and 0.33 feet per day in the northern portion of the site. Assuming the highest hydraulic conductivity measured, 57 feet per day, 0.002 groundwater gradient, 0.35% porosity, entry of the contaminant into the aquifer (hosted by the glacial till) in 1985 (beginning of landfill waste acceptance in the Deep Cells), the contaminant plume could have potentially traveled approximately 3,000 feet from its source (**Table 3**).

2.3 GROUNDWATER QUALITY

2.3.1 Organic Groundwater Quality

Selected December 2009 VOC concentrations in wells are summarized in **Table 4**. Tetrachloroethene (also referred to as PCE) is the only VOC that exceeds the human health standard or groundwater protection standard (DEQ 2008) at the site. All of the site monitoring wells, except wells SL-1 and SL-5 exceeded the standard. PCE concentrations ranged between 10 and 23 micrograms per liter ($\mu\text{g/L}$). The 1,500 foot, east-west width between PCE-impacted wells SL-6 and SL-9 dimension suggest relatively high dispersion from the source or multiple sources of PCE. The PCE concentration difference along the groundwater flow path, between wells SL-4 and SL-7, suggest that retardation of PCE is negligible.

The inferred extent of PCE in the northern part of the site, as detected in the monitoring well network, is shown in **Figure 4**. Concentration contours indicate that the highest detected PCE concentrations exist in wells SL-4 and SL-7. The position of the PCE concentration contours indicate a northerly elongation of the contaminant plume with wells SL-4 and SL-7 being near the approximate "peak concentration axis" of the plume. This agrees with an inferred northerly groundwater flow direction shown in **Figure 3**. The northern, or downgradient extent of PCE-impacted groundwater has not been determined in the present well network. To the east of these wells, concentrations of PCE decrease to non-detection (in well SL-5). To the west, and cross-(groundwater) gradient of these wells, concentrations remain above nine $\mu\text{g/L}$.

2.3.2 Inorganic Groundwater Quality

Selected inorganic parameters in wells SL-6 through SL-9 are summarized here. With exception to iron in well SL-7, there was no exceedance of human health standards or guidelines in these wells (DEQ, 2008).

Montana landfill inorganic parameters include chloride, sulfate, chemical oxygen demand (COD), cyanide, electrical conductivity, pH, nitrate+nitrite, and up to 17 metals. A discussion of inorganic results was presented in Richland County's report summarizing the November and December 2009 monitoring activities (Richland County 2010). Concentrations of inorganics and metal constituents in wells SL-6 through SL-9 are summarized in **Table 5**. pH and conductivity values in wells SL-6 through SL-9 are similar to wells SL-3 and SL-4, being near neutral pH and conductivities between 1,460 and 2,170 $\mu\text{mhos/cm}$. Chloride and sulfate concentrations ranged between 13 and 196 milligrams per liter (mg/L) and 96 and 281 mg/L , respectively. Nitrate+nitrite is highest over the cultivated area that wells SL-6 and SL-7 are located within or adjacent to (7.1 and 8.2 mg/L , respectively). Wells SL-8 and SL-9 have nitrate+nitrite concentrations of 3.1 and 3.5 mg/L , respectively. Metal concentrations in samples collected from monitoring wells were non-detect or near non-detect with exception to iron in well SL-7 that exceeded the Human Health Guideline (0.35 milligrams per liter, DEQ 2008).

3.0 SUMMARY AND CONCLUSIONS

The following summarizes data, calculations, and interpretations resulting from the investigations and monitoring in November and December 2009 at the Richland County Landfill #102:

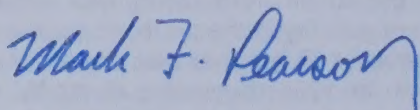
- The glacial till intercepted in the drilling of wells SL-6 through SL-9 and consists of sandy clay, clay, sand, and gravel. The greatest thickness of glacial till intercepted has been in wells SL-3 through SL-6, between 84 and 93 feet thickness. The drilling of wells SL-6 through SL-9 encountered sand and gravel deposits in the final five to 20 feet of drilling through glacial till before interception of the Fort Union Formation.
- The Fort Union was visually distinct and identified as gray shale intercepted in wells SL-6 through SL-9. Elevation differences of the top of Fort Union in wells SL-5 through SL-9 and wells SL-3 and SL-4 suggest that the contact of Fort Union with the glacial till dips generally to the south between 0.3 and 3.4%.
- Groundwater flow direction and gradient in the northern portion of the site was calculated from depth to groundwater measurements in wells SL-3 through SL-9. The November and December 2009 water level measurements indicate a groundwater flow direction to the northeast in the vicinity of the Deep Cells, changing to a northerly flow direction in the vicinity of wells SL-4 and SL-7.
- Aquifer tests were performed on all of the monitoring wells except wells SL-1 and SL-8 during November 2009. Hydraulic conductivities, calculated from the slug tests, were between 0.27 and 57 feet per day. The relatively wide range of hydraulic conductivity values may suggest the heterogeneous nature of the glacial till proximal to the Fort Union contact. For the northern vicinity of the site including wells SL-3 through SL-9, the average of all calculated hydraulic conductivities was 13.7 feet per day and the median of all calculated hydraulic conductivities was 5.8 feet per day.
- Groundwater velocity and potential length of travel for the contaminant plume was calculated. Groundwater velocities were between 0.01 and 0.33 feet per day in the northern portion of the site. Assuming a maximum hydraulic conductivity value of 57 feet per day and entry of the contaminant into the aquifer (hosted by the glacial till) in 1985 (beginning of landfill waste acceptance in the Deep Cells), the contaminant plume has had the potential to travel approximately 3,000 feet from its source.
- PCE was detected in all of the new groundwater monitoring wells (SL-6 through SL-9) in concentrations that exceed the MDEQ Circular DEQ-7 human health standard (groundwater protection standard). PCE concentration and gradient indicate a northerly direction of groundwater flow with the axis of greatest concentration (in groundwater) centered along wells SL-4 and SL-7.
- The northern, or downgradient, extent of the PCE-impacted groundwater has not been determined in the present well network.
- The 1,500 foot, east-west width between PCE-impacted wells SL-6 and SL-9 dimension suggest relatively high dispersion from one source or multiple sources of PCE. Richland County believes that a likely source area is the Deep Cells refuse area.

4.0 RECOMMENDATIONS

In consideration of the above information, the following recommendations are provided:

- The extent of PCE-impacted groundwater has not been determined. Investigation and groundwater monitoring data indicate groundwater flow and contaminant plume travel in a northeast changing to a northerly direction. Therefore, additional groundwater monitoring points need to be established to determine the total downgradient extent. Tetra Tech has proposed that up to five monitoring wells be drilled and completed north of well SL-7. The drilling/installation and measurement of groundwater elevations of new monitoring wells would be completed in a phased approach such that groundwater flow direction can be calculated during the drilling program and ensure the most accurate placement of wells.
- December 2009 monitoring results indicated that the extent of PCE-impacted groundwater was not determined to the west of well SL-9. However, since this aspect of the contaminant plume appears to be cross-gradient with respect to groundwater flow, has decreasing concentrations of PCE from the plume center to the west, and exists in un-occupied agricultural land, it is recommended that no further investigation be conducted northwest of well SL-3.
- Richland Co. personnel feel that the Deep Cells area is a significant source of chlorinated solvent concentrations in groundwater. Furthermore, they have requested consideration of additional corrective measures in the vicinity of the Deep Cells that would potentially decrease chlorinated solvent concentrations in groundwater flowing off of the landfill property. Tetra Tech recommends a review of previously compiled remedial alternatives along with current monitoring data, in consideration of the Deep Cells being the source of chlorinated solvents in groundwater. In addition, testing of the existing passive landfill gas extraction (LGE) system should be conducted to determine its performance in the collection of volatile organic compounds, namely, chlorinated solvents.

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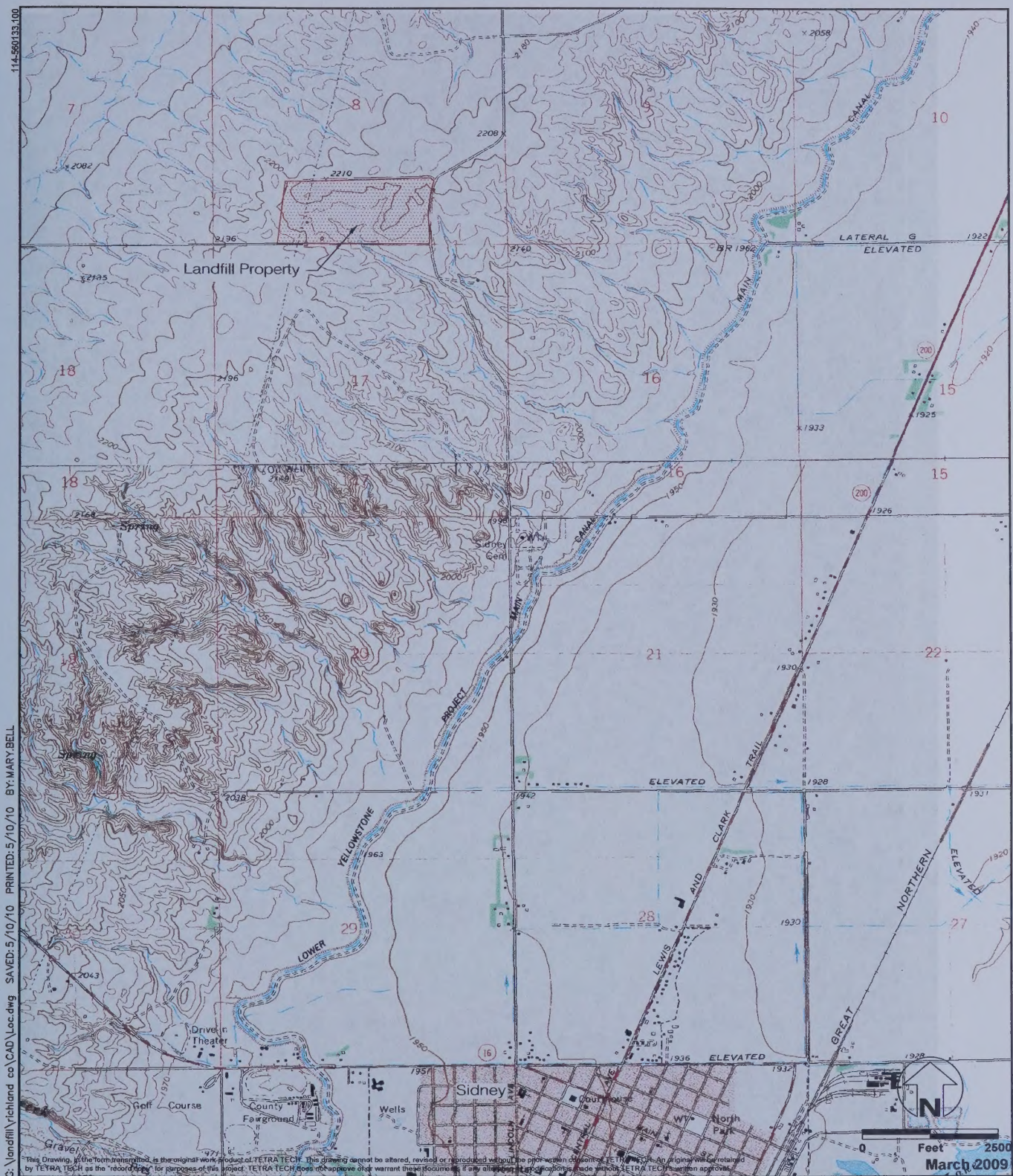
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APPENDIX A

FIGURES

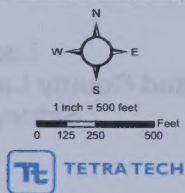
- FIGURE 1 Location Map
- FIGURE 2 Site Vicinity
- FIGURE 3 Groundwater Contour Map
- FIGURE 4 Tetrachloroethene in Monitoring Wells



Location Map
Former Richland County Landfill #102
Sidney, Montana
FIGURE 1



May, 2010



Legend

- Landfill Boundary
- Cultivated Field
- Waste Area Deep
- Waste Area Shallow
- Spring
- Burnpit
- Elevation Contour (feet)

(Source: USGS 1/3-Arc Second National Elevation Dataset. Does not correspond to surveyed well elevations.)

- Calculated Groundwater Flow Direction (December 2009)
- Groundwater Monitoring Well
- Abandoned Water Supply Well
- Methane Monitoring Well

Site Vicinity
Former Richland
County Landfill #102
Sidney, Montana

Figure 2



1 inch = 500 feet
0 125 250 500 Feet

Legend

- Landfill Boundary
- Waste Area Deep
- Cultivated Field
- Waste Area Shallow
- Burndip
- Elevation Contour (feet)
- Spring

(Source: USGS 1/3-Arc Second National Elevation Dataset. Does not correspond to surveyed well elevations.)

- Groundwater Monitoring Well (December 16, 2009 - Groundwater elevation in feet above mean sea level)
- Groundwater Elevation Contour (feet)

May 2010

Groundwater Contour Map

**Former Richland
County Landfill #102
Sidney, Montana**

Figure 3



APPENDIX B

TABLES

TABLE 1 Summary of Lithology and Monitoring Well Specifications

TABLE 2 Summary of Results of Aquifer Slug Tests

TABLE 3 Calculation of Groundwater Velocity and Estimate of Plume Travel

TABLE 4 Summary of Selected Chlorinated Solvent Compound Concentrations

TABLE 5 Summary of Selected Inorganic Constituent Concentrations

TABLE 1
SUMMARY OF LITHOLOGY AND MONITORING WELL SPECIFICATIONS
FORMER RICHLAND COUNTY LANDFILL #102
SIDNEY, MONTANA

MONITORING WELL	MEASURING POINT ELEVATION	GROUND SURFACE ELEVATION	Depth below Ground Surface			DEPTH TO WATER	GROUND WATER ELEVATION	THICKNESS SATURATED INTERVAL	UNCONSOL SEDIMENTS INTERVAL	ELEVATION TOP OF FORT UNION
			DEPTH TO TOP OF SCREEN	DEPTH TO BOTTOM OF SCREEN	WELL TOTAL DEPTH					
SL-1	1,964.05	1 1,962.1	25.9	30.9	32.4	29.86	1934.19	2.6	26	1,932
SL-2	1,985.48	2 1,983.6	48.9	58.9	59.1	52.99	1932.49	7.0	55	1,926
SL-3	2,009.73	3 2,008.2	73.0	88.0	92.0	76.45	1933.28	16.0	88	1,917
SL-4	2,011.63	2,009.2	79.5	89.5	94.0	78.84	1932.79	13.6	90	1,919
SL-5	2,018.06	2,015.3	84.0	94.0	95.0	85.42	1932.64	10.3	93	1,922
SL-6	2,011.73	2,009.2	79.5	84.5	85.0	79.37	1932.36	7.2	84	1,925
SL-7	1,996.09	1,994.4	68.0	73.0	74.0	64.08	1932.01	10.6	73	1,921
SL-8	1,989.20	1,987.9	51.5	56.5	57.0	56.01	1933.19	1.3	56	1,932
SL-9	1,972.51	1,971.6	39.4	44.4	46.0	39.38	1933.13	6.5	45	1,927

Notes

All units in feet

Elevations in feet above mean sea level

Ground surface elevations are difference between measuring point elevation and distance to ground surface

Depth to water measurements were collected on December 16, 2009

Thickness saturated interval based on December 16, 2009 depth to water measurements

1 : Casing extended 4.41 feet

2 : Casing extended 3.06 feet

3 : Casing extended 2.97 feet

TABLE 2
SUMMARY OF RESULTS OF AQUIFER SLUG TESTS
FORMER RICHLAND COUNTY LANDFILL #102
SIDNEY, MONTANA

WELL	HYDRAULIC CONDUCTIVITY (feet/day)	
	Slug In	Slug Out
SL-1	Insufficient water column	
SL-2	9.2	53
SL-3	25	31
SL-4	1.5	0.63
SL-5	0.32	0.27
SL-6	5.7	2.7
SL-7	11	5.8
SL-8	Insufficient water column	
SL-9	23	57
Average slug test K in northern vicinity of landfill and north of the landfill, in vicinity of downgradient wells (SL-3 - 9) :		13.66
Median slug test K (wells SL-3 - 9) :		5.75
Maximum slug test K (well SL-9) :		57

TABLE 3
CALCULATION OF GROUNDWATER VELOCITY AND ESTIMATE OF PLUME TRAVEL
FORMER RICHLAND COUNTY LANDFILL #102
SIDNEY, MONTANA

				Low Value	High Value	
Data Input :						
Hydraulic Conductivity (K) :				Median 5.8	SL-9 Slug Test K 57.0 feet/day	
Groundwater Gradient (Grad _{gw}) : Based on December 2009 Groundwater Measurements				SL-4 to SL-7 0.0006	SL-8 to SL-7 0.0020 feet	
Porosity (n):	Upper range value for mixed sand & gravel (Fetter, 1988)			0.35	0.35 %	
Landfill Waste Acceptance :				Deep Cells duration 1995 15	1985 25 year years ago	
Assume no retardation of PCE						
Calculated Groundwater Velocity : $V_{gw} = \frac{Grad_{gw} \cdot K}{n}$				0.010	0.326 feet/day	
PCE Plume Travel Distance:		years	365 days	GW vel	54	2,972 feet
(downgradient)			year			

TABLE 4
SUMMARY OF SELECTED CHLORINATED SOLVENT COMPOUND CONCENTRATIONS
FORMER RICHLAND COUNTY LANDFILL #102
SIDNEY, MONTANA

Well	Date	Chloroform (TCM)	1,1 Dichloroethane (11DCA)	c1,2 Dichloroethene (c12DCE)	Tetrachloroethene (PCE)	1,1,1 Trichloro -ethane (111TCA)	Trichloroethene (TCE)	Dichlorodifluoro -methane (Freon 11)	Total Chlorinated Solvents
Human Health Std		70 HA	--	4	5	200	5	1,000	--
SL-1	12/1/2009	ND	ND	0.9	ND	ND	ND	ND	0.9
SL-2	12/1/2009	1.2	ND	ND	5.7	0.64	ND	0.35	7.9
SL-3	12/1/2009	0.84	3.4	3	9.1	1.4	1.2	3.1	22.0
SL-4	12/1/2009	0.6	0.31	0.4	27	0.39	0.7	0.38	29.8
SL-5	12/1/2009	ND	ND	ND	ND	ND	ND	ND	0.0
SL-6	12/1/2009	ND	ND	0.29	12	ND	0.33	ND	12.6
SL-7	12/1/2009	0.37	1	0.53	23	2.8	0.92	0.43	29.1
SL-8	12/1/2009	0.37	1.3	0.37	14	1.6	0.44	ND	18.1
SL-9	12/1/2009	0.72	3.7	2.3	10	1.3	0.97	1.6	20.6
<u>Other volatile organic compound concentrations</u>									
Well	Date	Benzene	Toluene	Notes: Abbreviation of parameter name shown in parenthesis Concentrations in micrograms per liter Human Health Standard is also Groundwater Protection Standard HA : Health Advisory					
Human Health Std		5	1,000						
SL-1	12/1/2009								
SL-2	12/1/2009								
SL-3	12/1/2009	0.56							
SL-4	12/1/2009								
SL-5	12/1/2009								
SL-6	12/1/2009	3.1	0.34						
SL-7	12/1/2009								
SL-8	12/1/2009								
SL-9	12/1/2009								

TABLE 5
SUMMARY OF SELECTED INORGANIC CONSTITUENT CONCENTRATIONS
FORMER RICHLAND COUNTY LANDFILL #102
SIDNEY, MONTANA

Well	Sample Date	pH (s.u.)	Conductivity (µmhos/cm)	Alkalinity (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	COD (mg/L)	Nitrate+Nitrite (mg/L)
Human Health Std		--	--	--	--	--	--	10
SL-6	12/1/2009	7.4	1460	585	45	166	15	7.1
SL-7	12/1/2009	7	1600	733	14	154	23	8.2
SL-8	12/1/2009	7	1850	785	13	281	30	3.08
SL-9	12/1/2009	6.9	2170	860	196	96	12	3.48
Well	Sample Date	Arsenic (mg/L)	Barium (mg/L)	Cobalt (mg/L)	Iron (mg/L)	Nickel (mg/L)	Selenium (mg/L)	Cyanide (mg/L)
Human Health Std		0.01	2	--	0.3 HHG	0.1	0.05	5
SL-6	12/1/2009	ND	0.1	ND	ND	ND	0.009	ND
SL-7	12/1/2009	ND	ND	ND	0.35	0.01	ND	ND
SL-8	12/1/2009	ND	0.2	0.02	ND	0.03	ND	ND
SL-9	12/1/2009	ND	0.2	0.02	0.09	0.01	0.012	ND

Notes:
 Only detected metal constituents shown
 Concentrations in milligrams per liter
 Human Health Standard is also Groundwater Protection Standard
 HHG : Human Health Guideline

Drilling Logs

PROJECT: NUMBER: 114-560133
 NAME: Richland County Landfill
(old landfill)
 DRILL TYPE: SOIL: AIR ROTARY w/ casing Hammer
 ROCK: _____
 DRILLED BY: H&H Drilling - Glendale
 LOGGED BY: PAUL LAMORE
 REMARKS: _____

MONITORING WELL/BORING NO. SL-6
 SHEET 1 OF 2
 LOCATION: _____
 ELEVATION: TOP OF HOLE: _____
 (ft) GROUNDWATER: 77.3 ft
 DATE: STARTED: 11/9/07 COMPLETED: 11/10/07

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
0.0		0-1 TOPSOIL; Gravel, sand, clay and silt; moist; brown	Continuous sampling of cuttings				None	None
5.0		1-13 GRAVEL; small size; sand; silt; some clay; dry; brown						
10.0		13-30 SAND; fine to med. grain; poorly sorted; brown; loose; moist						
15.0		30-40 SAND; w/ some small shale pieces; loose; poorly sorted; brown; moist						
20.0		40-50 Silty SAND w/ some clay; moist; brown						
25.0		50-60 SAND; w/ some silt; fine to med. grain; moist; loose; brown						
30.0		60-65 GRAVEL w/ sand; fine-grain sand; moist; granitic gravel						

CAL = CALIFORNIA
 SS = SPLIT SPOON
 ST = SHELBY TUBE
 DB = DISTURBED BULK /BAG SAMPLE

CON = CONTINUOUS SAMPLE
 CORE = CORE SAMPLE
 CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
 "X" = NOT ANALYZED

NS = NO SHEEN
 SS = SLIGHT SHEEN
 MS = MODERATE SHEEN
 HS = HEAVY SHEEN

DEPTH TO BOTTOM OF BORING
85 FT

TETRA TECH

PROJECT: NUMBER: 114-560133
NAME: Richland County Landfill
(OLD LAND FILL)

MONITORING WELL NO. SL-6
SHEET 1 OF 1
LOCATION: _____

DRILL TYPE: SOIL: _____
ROCK: _____
DRILLED BY: _____
LOGGED BY: _____
REMARKS: _____

DATE: HOLE STARTED: 11/9/09
COMPLETED: 11/10/09

ELEVATIONS

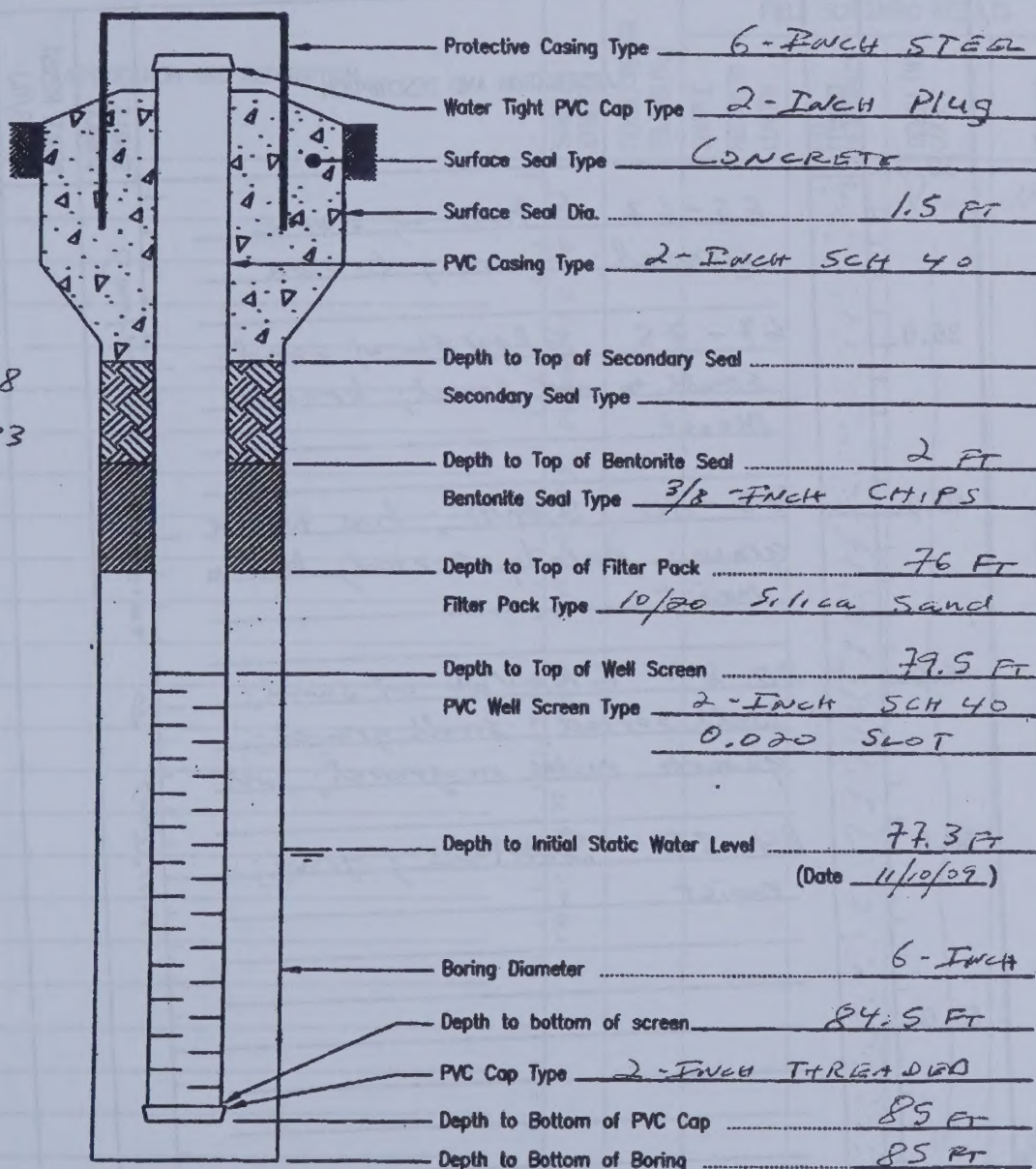
Top of Protective Casing 2214 FT
Top of PVC Casing _____
Top of Ground Surface 2210 FT

N 47.76688
E -104.17133

Groundwater _____

Bottom of Well Screen _____

Bottom of Boring _____



NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

TE TETRA TECH

PROJECT: NUMBER: 114-560133
NAME: Richland County Landfill
(OLD LANDFILL)

MONITORING WELL/BORING NO. SL-6
SHEET 2 OF 2
LOCATION: _____

DRILL TYPE: SOIL: Air Rotary w/ casing hammer

ROCK: _____

DRILLED BY: H & H DRILLING

LOGGED BY: PAUL LEMURE

REMARKS: _____

ELEVATION: TOP OF HOLE: _____
(ft) GROUNDWATER: 78.3 ft

DATE: STARTED: 11/9/09 COMPLETED: 11/10/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
30.0		65-67 SAND w/ some gravel; moist; brown	Continuous Sample or Cuttings				None	None
35.0		67-75 GRAVEL w/ sand; small to med gravel; brown; moist						
40.0		75-80 SAND; fine to med grain; poorly sorted; brown moist						
45.0		80-84 GRAVEL w/ sand; well sorted; small gravel; quartz rocks in gravel; wet						
50.0		84-85 SHALE; gray; moist						
55.0								
60.0								

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK /BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
-- = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN

DEPTH TO BOTTOM OF BORING
85 ft

TE TETRA TECH

MONITORING WELL/BORING NO. SL-6
SHEET OF
LOCATION:

ELEVATION: TOP OF HOLE: _____
(ft) GROUNDWATER: _____
DATE: STARTED: 4/9/05 COMPLETED: 11/10/09

[illegible]

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN

TETRA TECH

PROJECT: NUMBER: 164-560133
 NAME: Richland County Landfill
(old landfill)
 DRILL TYPE: SOIL: AIR ROTARY w/ casing hammer
 ROCK: _____
 DRILLED BY: H & H Drilling - Glendora
 LOGGED BY: Paul Lemire
 REMARKS: _____

MONITORING WELL/BORING NO. SL-7
 SHEET 1 OF 2
 LOCATION: _____

ELEVATION: TOP OF HOLE: _____
 (ft) GROUNDWATER: 63.80 ft
 DATE: STARTED: 11/11/09 COMPLETED: 11/12/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
0.0		0-1 Topsoil; sand, silt and clay; dry	Continuous Sample or Cuttings				None	None
5.0		1-15 CLAY, sandy w/ silt; brown; dry						
10.0		15-30 CLAY w/ sand and rock (shale) chips; occasional quartz rock chips; dry to moist						
15.0		30-35 CLAY w/ sand and gravel; small gravel; moist						
20.0		35-43 SAND; med size grain; well sorted; loose; moist						
25.0		43-47 GRAVEL; small size; w/ sand; loose; moist						
30.0		47-55 GRAVEL; small to med. size; coarse-grain sand; well sorted						

CAL = CALIFORNIA
 SS = SPLIT SPOON
 ST = SHELBY TUBE
 DB = DISTURBED BULK /BAG SAMPLE

CON = CONTINUOUS SAMPLE
 CORE = CORE SAMPLE
 CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
 -- = NOT ANALYZED

NS = NO SHEEN
 SS = SLIGHT SHEEN
 MS = MODERATE SHEEN
 HS = HEAVY SHEEN
 -- =

DEPTH TO BOTTOM OF BORING
74 FT

 TETRA TECH

PROJECT: NUMBER: 114-560133
NAME: Richland County
(OLD LAND FILL)

MONITORING WELL NO. SL-7
SHEET 1 OF 1
LOCATION: _____

DRILL TYPE: SOIL: AIR ROTARY w/ Casing Hammer
ROCK: _____
DRILLED BY: H&H Drilling - Glendive
LOGGED BY: Paul Lense
REMARKS: _____

DATE: HOLE STARTED: 11/11/09
COMPLETED: 11/12/09

ELEVATIONS

Top of Protective Casing

Top of PVC Casing

Top of Ground Surface

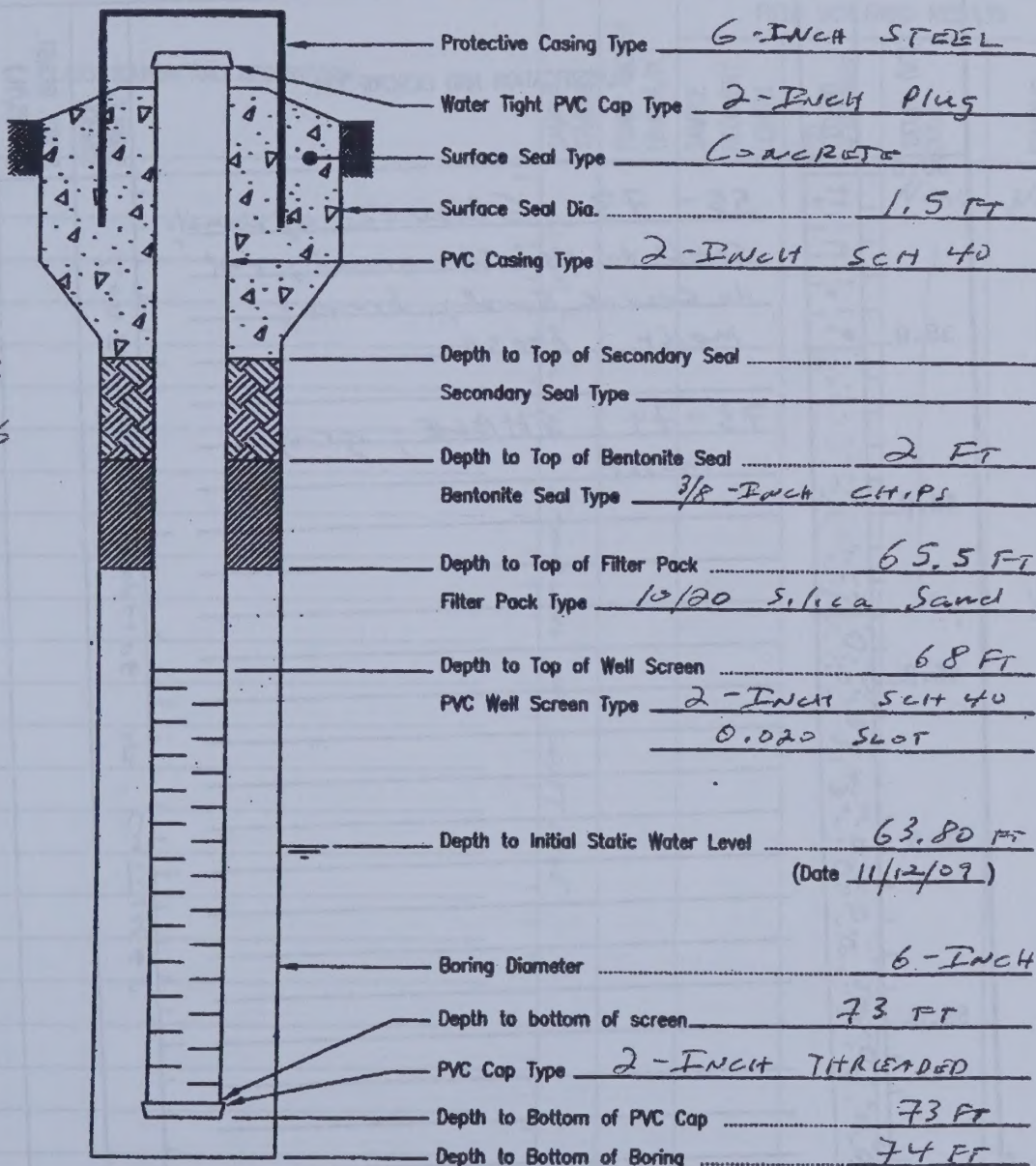
N 47.76743

E -104.17336

Groundwater

Bottom of Well Screen

Bottom of Boring



NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

 TETRATECH

PROJECT: NUMBER: 114-560133
NAME: Richland County Landfill
(old land fill)

MONITORING WELL/BORING NO. SL-7
SHEET 2 OF 2
LOCATION: _____

DRILL TYPE: SOIL: Air Rotary w/casing hammer
ROCK: _____

DRILLED BY: H & H Drilling - Gleadale

LOGGED BY: Paul Levine

REMARKS: _____

ELEVATION: TOP OF HOLE: _____
(ft) GROUNDWATER: 63.80 ft

DATE: STARTED: 11/11/09 COMPLETED: 4/22/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
30.0		55-73 GRAVEL w/ sand; small to med size gravel; med to coarse sand; brown; moist; loose	Continuous Sampling of Cuttings				None	None
35.0		73-74 SHALE; gray; moist						
40.0								
45.0								
50.0								
55.0								
60.0								

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK
/BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR
CHEMICAL ANALYSIS
-- = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN
-- =

DEPTH TO BOTTOM OF BORING

74 ft



TETRA TECH

PROJECT: NUMBER: 114-560133
NAME: Richland County Landfill

MONITORING WELL/BORING NO. SL-7

SHEET 2 OF 2

LOCATION: _____

DRILL TYPE: SOIL: Air Rotary

ROCK: _____

DRILLED BY: H & H Drilling

LOGGED BY: Paul Lemire

REMARKS: _____

ELEVATION: TOP OF HOLE: _____

(ft) GROUNDWATER: 63.80 ft

DATE: STARTED: 11/11/07 COMPLETED: 11/12/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
60.0			Continuous Sample or Cuttings				None	None
65.0								
70.0								
75.0								
80.0								
85.0								
90.0								

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK /BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
- = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN
- =

DEPTH TO BOTTOM OF BORING

74 ft



TETRA TECH

PROJECT: NUMBER: 114-S60133
NAME: Richland County Landfill
(old landfill)

MONITORING WELL/BORING NO. 5L-8

SHEET 1 OF 2

LOCATION: _____

DRILL TYPE: SOIL: AIR ROTARY w/ Casing Hammer

ROCK: _____

DRILLED BY: H & H DRILLING - Glendive

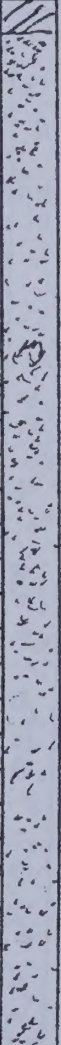
LOGGED BY: PAUL LEMIRE

REMARKS: _____

ELEVATION: TOP OF HOLE: _____

(ft) GROUNDWATER: 56.02 FT

DATE: STARTED: 4/12/09 COMPLETED: 4/13/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
0.0		0-1 TOPSOIL; sand, silt and gravel; dry	Continuous Sampling of Cuttings				None	None
5.0		1-5 SAND w/ small gravel; med grain sand; loose; brown; moist						
10.0		5-30 SAND; loose; poorly sorted; med grain size; brown; moist						
15.0		30-38 SAND w/ small gravel; med. grain sand; loose; moist						
20.0		38-42 CLAY; brown; moist; occasional gravel						
25.0		42-56 GRAVEL w/ sand; small to med. gravel; coarse sand; loose; moist to wet						
30.0		56-57 SHALE; gray; moist						

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK /BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
-- = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN
-- =

DEPTH TO BOTTOM OF BORING
57. FT

 TETRA TECH

PROJECT: NUMBER: 114-560133
NAME: Richland County Landfill
(old landfill)
DRILL TYPE: SOIL: Air Rotary w/ Casing Hammer
ROCK: _____
DRILLED BY: H&H Drilling
LOGGED BY: Pam Lemire
REMARKS: _____

MONITORING WELL NO. SL-8
SHEET 1 OF 1
LOCATION: _____
DATE: HOLE STARTED: 11/11/09
COMPLETED: 11/12/09

ELEVATIONS

Top of Protective Casing
2196
Top of PVC Casing

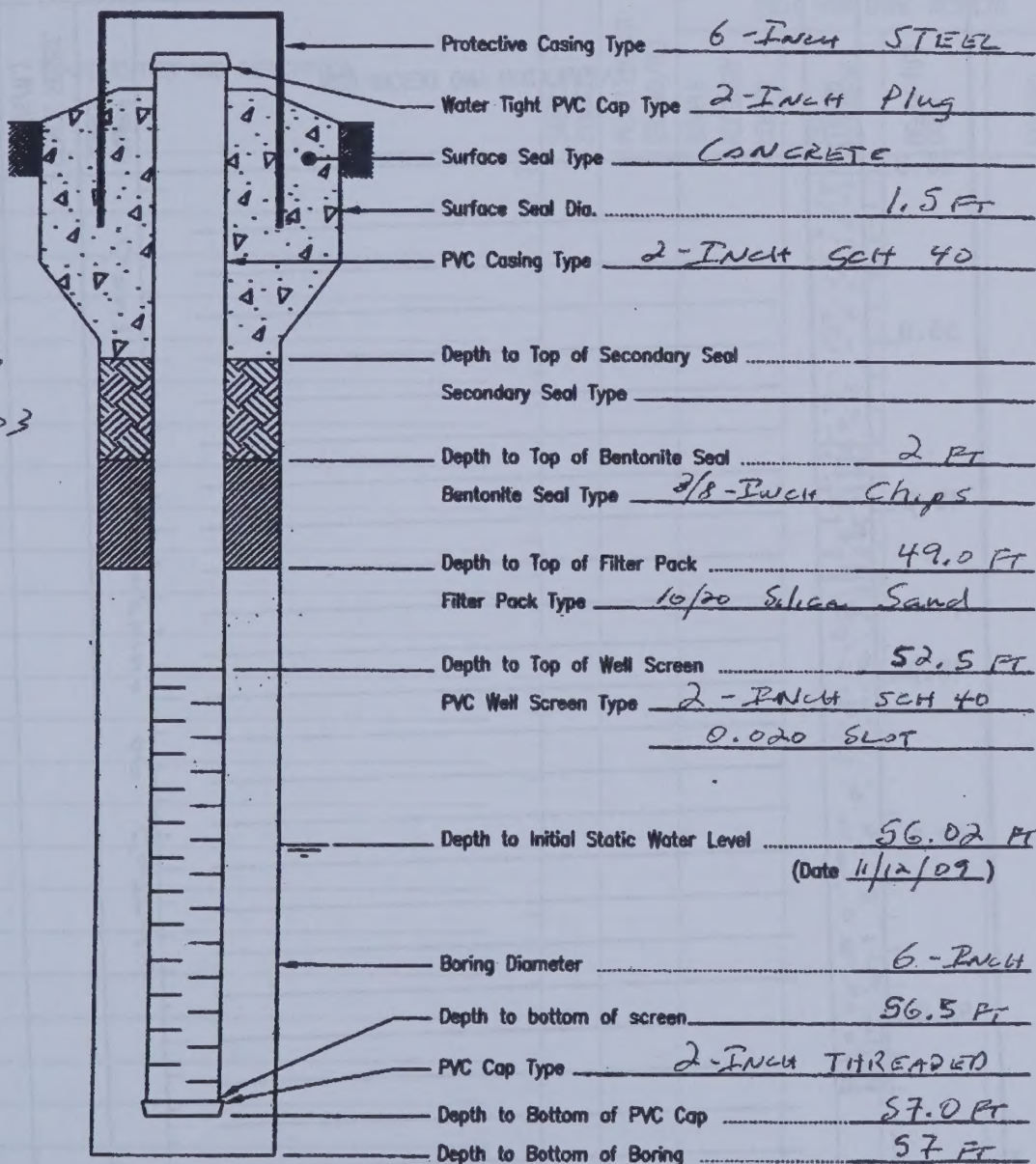
Top of Ground Surface
2193

N 47.76656
E - 104.17503

Groundwater

Bottom of Well Screen

Bottom of Boring



NOT TO SCALE

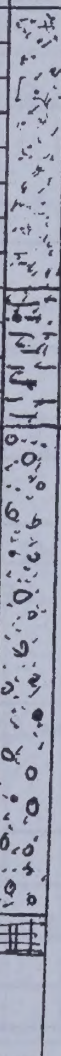
NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: 114-560 133
NAME: Richland County Landfill
(old landfill)

MONITORING WELL/BORING NO. SL-8
SHEET 2 OF 2
LOCATION: _____

DRILL TYPE: SOIL: A.R. Rotary
ROCK: _____
DRILLED BY: H & H Drilling
LOGGED BY: Rand Lemire
REMARKS: _____

ELEVATION: TOP OF HOLE: _____
(ft) GROUNDWATER: 56.02 FT
DATE: STARTED: 4/12/09 COMPLETED: 4/13/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
30.0			CONTINUOUS SAMPLES OR CUTTINGS				None	None
35.0								
40.0								
45.0								
50.0								
55.0								
60.0								

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK /BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
"- " = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN

DEPTH TO BOTTOM OF BORING

 TETRA TECH

PROJECT: NUMBER: _____
 NAME: _____
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL/BORING NO. _____
 SHEET ____ OF ____
 LOCATION: _____
 ELEVATION: TOP OF HOLE: _____
 (ft) GROUNDWATER: _____
 DATE: STARTED: _____ COMPLETED: _____

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS				
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING	
60.0									
65.0									
70.0									
75.0									
80.0									
85.0									
90.0									

CAL = CALIFORNIA CON = CONTINUOUS SAMPLE NS = NO SHEEN -- = _____
 SS = SPLIT SPOON CORE = CORE SAMPLE SS = SLIGHT SHEEN -- = _____
 ST = SHELBY TUBE CA = SAMPLE SUBMITTED FOR MS = MODERATE SHEEN -- = _____
 DB = DISTURBED BULK CHEMICAL ANALYSIS HS = HEAVY SHEEN -- = _____
 /BAG SAMPLE "-" = NOT ANALYZED -- = _____

DEPTH TO BOTTOM OF BORING _____



PROJECT: NUMBER: 114-S60133
 NAME: Richland County Landfill

MONITORING WELL/BORING NO. SL-9
 SHEET 1 OF 2

LOCATION: _____

DRILL TYPE: SOIL: Air Rotary w/ Casing Hammer

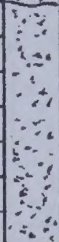
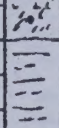
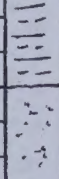
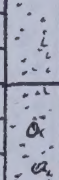
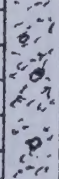
ROCK: _____
 DRILLED BY: H & H Drilling - Glendive

LOGGED BY: PAUL LEMIRE

REMARKS: _____

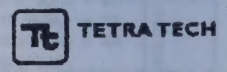
ELEVATION: TOP OF HOLE: _____
 (ft) GROUNDWATER: 29.62 FT

DATE: STARTED: 11/13/09 COMPLETED: 11/13/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
0.0		0-2 Topsoil; sand, silt clay and gravel; moist	Continuous Sampling at Cuttings				NONE	NONE
5.0		2-10 SAND; med to coarse grain; poorly sorted; brown moist						
10.0		10-15 CLAY; soft; brown; some silt; moist						
15.0		15-20 SAND; med to coarse grain; brown; poorly sorted; moist						
20.0		20-30 SAND w/ gravel; poorly sorted; med. gravel; brown; moist						
25.0		30-35 GRAVEL w/ sand; med gravel; brown; moist						
30.0		35-40 GRAVEL w/ sand; small to med gravel; brown; moist						

CAL = CALIFORNIA COM = CONTINUOUS SAMPLE NS = NO SHEEN _____
 SS = SPLIT SPOON CORE = CORE SAMPLE SS = SLIGHT SHEEN _____
 ST = SHELBY TUBE CA = SAMPLE SUBMITTED FOR MS = MODERATE SHEEN _____
 DB = DISTURBED BULK CHEMICAL ANALYSIS HS = HEAVY SHEEN _____
 /BAG SAMPLE " " = NOT ANALYZED _____

DEPTH TO BOTTOM OF BORING
46 FT



D:\WORK FILES\Temp\11-11-09\SL-9.dwg

PROJECT: NUMBER: 114-560133
 NAME: Richland County Landfill
(old landfill)
 DRILL TYPE: SOIL: AIR ROTARY w/ Casing Hammer
 ROCK: _____
 DRILLED BY: H & H Drilling
 LOGGED BY: Paul Lemire
 REMARKS: _____

MONITORING WELL NO. SL-9
 SHEET 1 OF 1
 LOCATION: _____
 DATE: HOLE STARTED: 11/13/09
 COMPLETED: 11/13/09

ELEVATIONS

Top of Protective Casing

Top of PVC Casing

Top of Ground Surface
2178

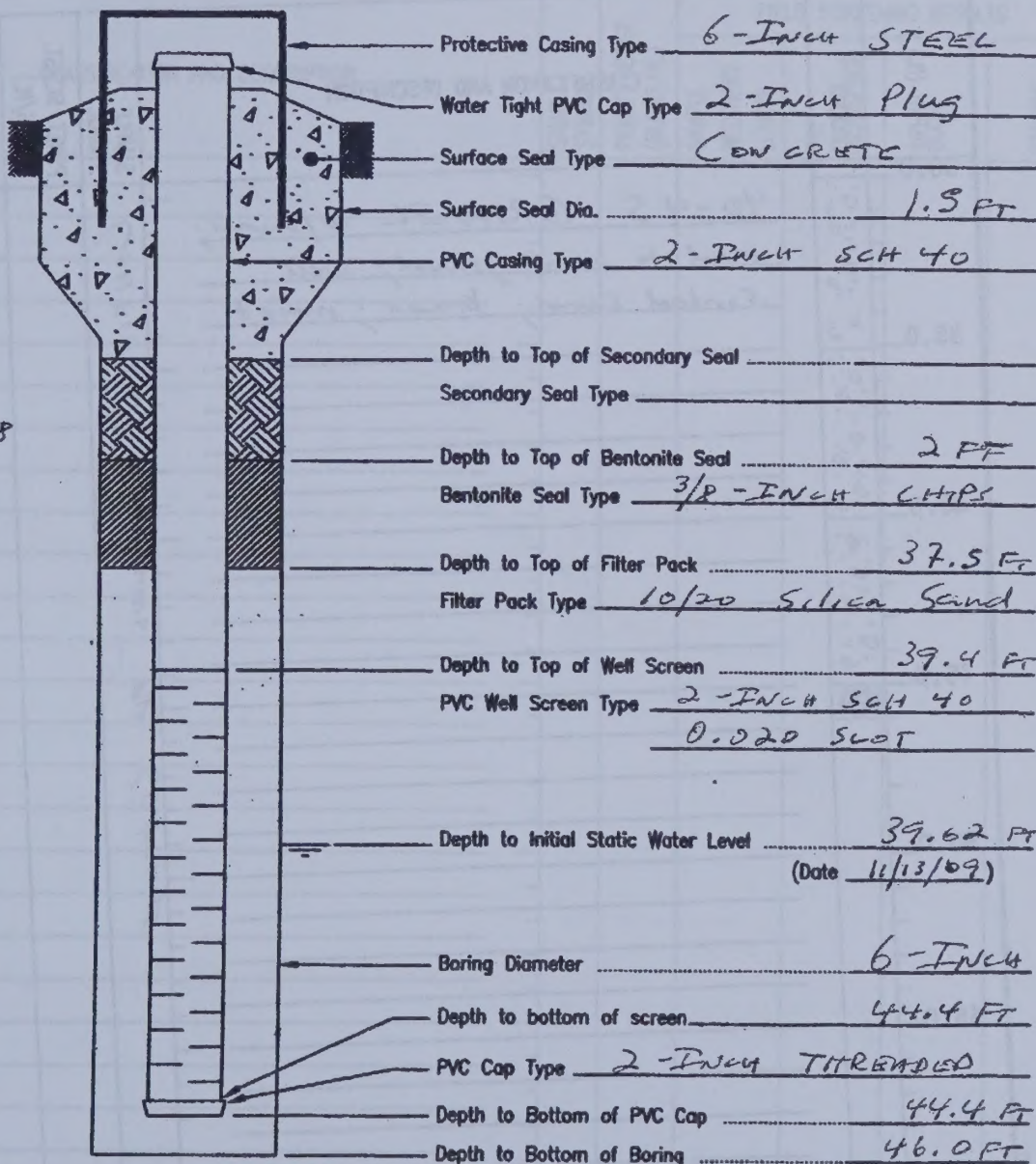
N 47.76625

E -104.17768

Groundwater

Bottom of Well Screen

Bottom of Boring



NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: 114-560133
NAME: Richland County Landfill
old landfill

MONITORING WELL/BORING NO. SL-9
SHEET 2 OF 2
LOCATION: _____

DRILL TYPE: SOIL: AIR ROTARY w/ Casing Hammer

ROCK: _____

DRILLED BY: H & H DRILLING

LOGGED BY: PAUL LEMIRE

REMARKS: _____

ELEVATION: TOP OF HOLE: _____
(ft) GROUNDWATER: 37.62 FT

DATE: STARTED: 11/13/09 COMPLETED: 11/17/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
30.0		40-45 GRAVEL w/sand, med to small gravel; well sorted sand; brown; moist	Continuous Sample or Cuttings				NONE	NONE
35.0								
40.0								
45.0								
50.0								
55.0								
60.0								

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK /BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
"-" = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN

DEPTH TO BOTTOM OF BORING

46 FT



TETRA TECH

MONITORING WELL/BORING NO. _____

SHEET ____ OF ____

LOCATION: _____

DRILL TYPE: SOIL: _____

ROCK: _____

DRILLED BY: _____

LOGGED BY: _____

REMARKS:

ELEVATION: TOP OF HOLE: _____

(ft) GROUNDWATER: _____

DATE: STARTED: _____ COMPLETED: _____

[illegible]

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK
/BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR
CHEMICAL ANALYSIS
"-" = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN

DEPTH TO BOTTOM OF BORING



TETRA TECH

Aquifer Slug Tests Calculations

PROJECT: RICHLAND COUNTY OLD LANDFILL

INPUT

Construction:	
Casing dia. (d_c)	2 Inch
Annulus dia. (d_w)	6 Inch
Screen Length (L)	10 Feet
Depths to:	
water level (DTW)	53.05 Feet
top of screen (TOS)	45.8 Feet
Base of Aquifer (DTB)	55.8 Feet
Annular Fill:	
across screen --	Coarse Sand
above screen --	Bentonite
Aquifer Material --	
Sand and Gravel Mixes	

COMPUTED

L_{wetted}	2.75 Feet
D =	2.75 Feet
H =	2.75 Feet
L/r_w	11.00
y_0 -DISPLACEMENT =	2.22 Feet
y_0 -SLUG =	6.14 Feet
From look-up table using L/r_w	

Fully penetrate C = 1.281
 $\ln(Re/r_w) = 1.739$
 $Re = 1.42$ Feet

Slope = $0.021113 \log_{10}/\text{sec}$
 $t_{90\%}$ recovery = 47 sec

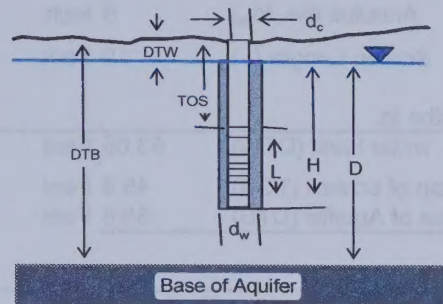
Slug discrepancy of 94% is greater than maximum of 20%

K = Error Feet/Day

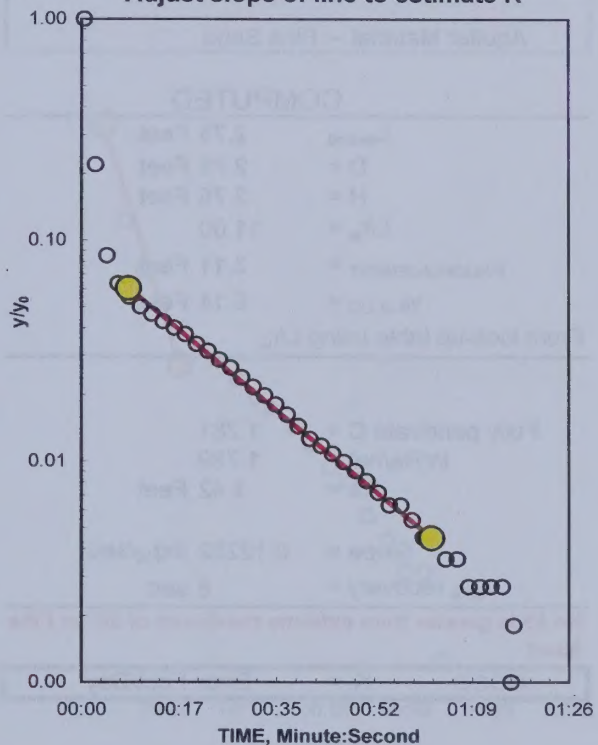
Local ID: SL-2 (Slug-In)

Date: 11/13/2009

Time: 0:00



Adjust slope of line to estimate K



K= 9.2 is less than likely minimum of 30 for Sand and Gravel Mixes

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

PROJECT: RICHLAND COUNTY OLD LANDFILL

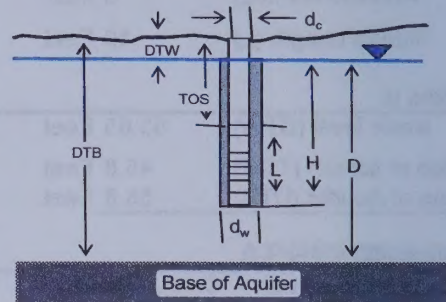
Local ID: SL-2 (Slug-Out)

Date: 11/13/2009

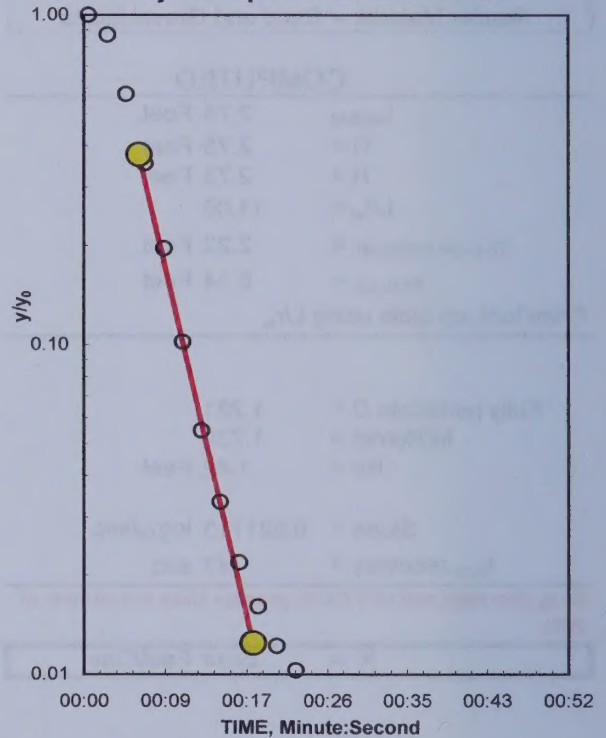
Time: 0:00

INPUT

Construction:	
Casing dia. (d_c)	2 Inch
Annulus dia. (d_w)	6 Inch
Screen Length (L)	10 Feet
Depths to:	
water level (DTW)	53.05 Feet
top of screen (TOS)	45.8 Feet
Base of Aquifer (DTB)	55.8 Feet
Annular Fill:	
across screen --	Medium Sand
above screen --	Bentonite
Aquifer Material -- Fine Sand	



Adjust slope of line to estimate K



COMPUTED

L_{wetted}	2.75 Feet
D =	2.75 Feet
H =	2.75 Feet
L/r_w	11.00
y_0 -DISPLACEMENT =	3.11 Feet
y_0 -SLUG =	6.14 Feet
From look-up table using L/r_w	
Fully penetrate C =	1.281
$\ln(Re/r_w)$ =	1.739
Re =	1.42 Feet
Slope =	0.12252 $\log_{10}/\text{sec}$
$t_{90\%}$ recovery =	8 sec
K= 53 is greater than extreme maximum of 20 for Fine Sand	
K = Error Feet/Day	

K= 53 is greater than likely maximum of 20 for Fine Sand

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

PROJECT: RICHLAND COUNTY OLD LANDFILL

Local ID: SL-3 (Slug-In)

Date: 11/13/2009

Time: 0:00

INPUT

Construction:

Casing dia. (d_c)	2 Inch
Annulus dia. (d_w)	6 Inch
Screen Length (L)	15 Feet

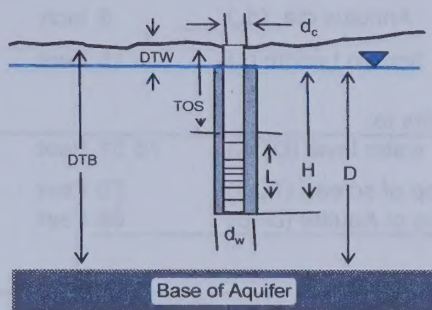
Depths to:

water level (DTW)	76.51 Feet
top of screen (TOS)	70 Feet
Base of Aquifer (DTB)	88 Feet

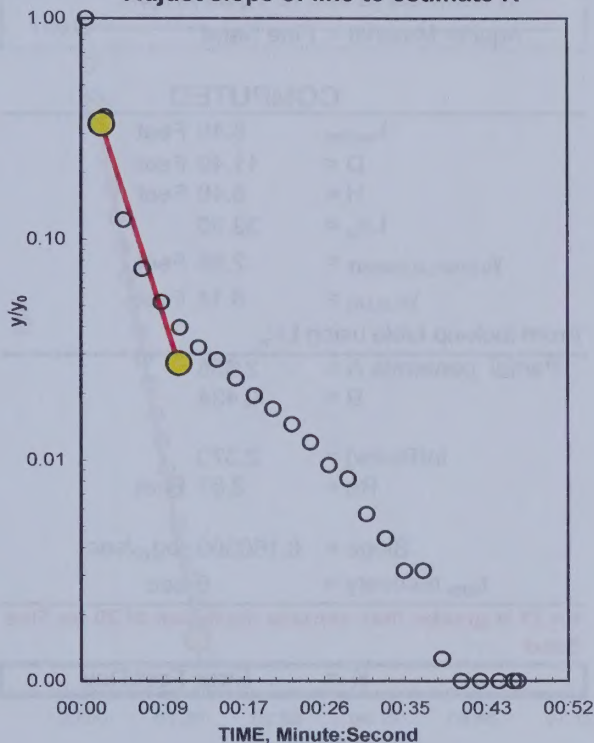
Annular Fill:

across screen -- Coarse Sand
above screen -- Bentonite

Aquifer Material -- Sand and Gravel Mixes



Adjust slope of line to estimate K



COMPUTED

L_{wetted}	8.49 Feet
$D =$	11.49 Feet
$H =$	8.49 Feet
$L/r_w =$	33.96
y_0 -DISPLACEMENT	1.58 Feet
y_0 -SLUG	6.14 Feet

From look-up table using L/r_w

Partial penetrate A	2.655
B	0.434

$\ln(Re/r_w) =$	2.370
Re	2.67 Feet

Slope	$0.132066 \log_{10}/\text{sec}$
$t_{90\%}$ recovery	8 sec

Slug discrepancy of 118% is greater than maximum of 20%

K = Error Feet/Day

K= 25 is less than likely minimum of 30 for Sand and Gravel Mixes

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

PROJECT: RICHLAND COUNTY OLD LANDFILL

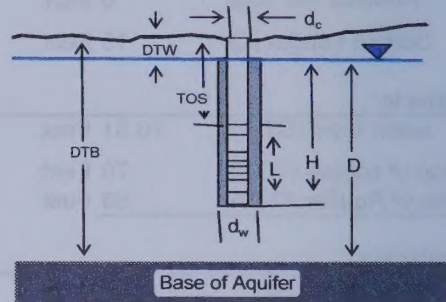
Local ID: SL-3 (Slug-Out)

Date: 11/13/2009

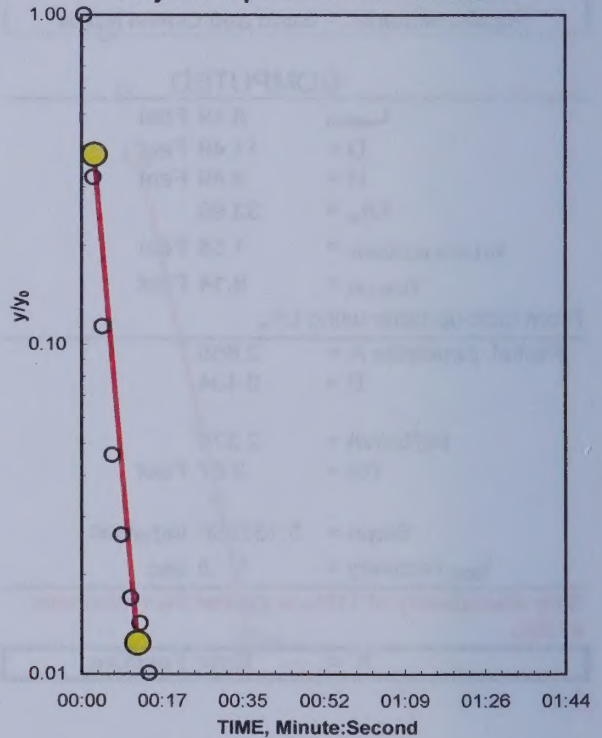
Time: 0:00

INPUT

Construction:	
Casing dia. (d_c)	2 Inch
Annulus dia. (d_w)	6 Inch
Screen Length (L)	15 Feet
Depths to:	
water level (DTW)	76.51 Feet
top of screen (TOS)	70 Feet
Base of Aquifer (DTB)	88 Feet
Annular Fill:	
across screen --	Medium Sand
above screen --	Bentonite
Aquifer Material --	
Fine Sand	



Adjust slope of line to estimate K



COMPUTED

L_{wetted}	8.49 Feet
D =	11.49 Feet
H =	8.49 Feet
L/r_w	33.96
y_0 -DISPLACEMENT =	2.88 Feet
y_0 -SLUG =	6.14 Feet
From look-up table using L/r_w	
Partial penetrate A =	2.655
B =	0.434
$\ln(Re/r_w)$ =	2.370
Re =	2.67 Feet
Slope =	0.160306 $\log_{10}/\text{sec}$
$t_{90\%}$ recovery =	6 sec
K= 31 is greater than extreme maximum of 20 for Fine Sand	
K = Error Feet/Day	

K= 31 is greater than likely maximum of 20 for Fine Sand

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

PROJECT: RICHLAND COUNTY OLD LANDFILL

Local ID: SL-4 (Slug-In)

Date: 11/12/2009

Time: 0:00

INPUT

Construction:

Casing dia. (d_c)	2 Inch
Annulus dia. (d_w)	8 Inch
Screen Length (L)	10 Feet

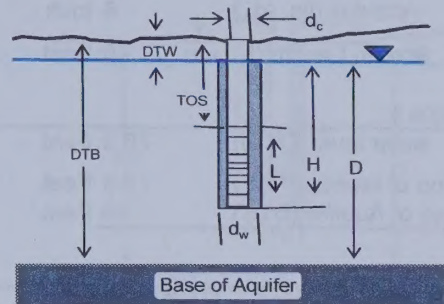
Depths to:

water level (DTW)	78.9 Feet
top of screen (TOS)	79.5 Feet
Base of Aquifer (DTB)	90 Feet

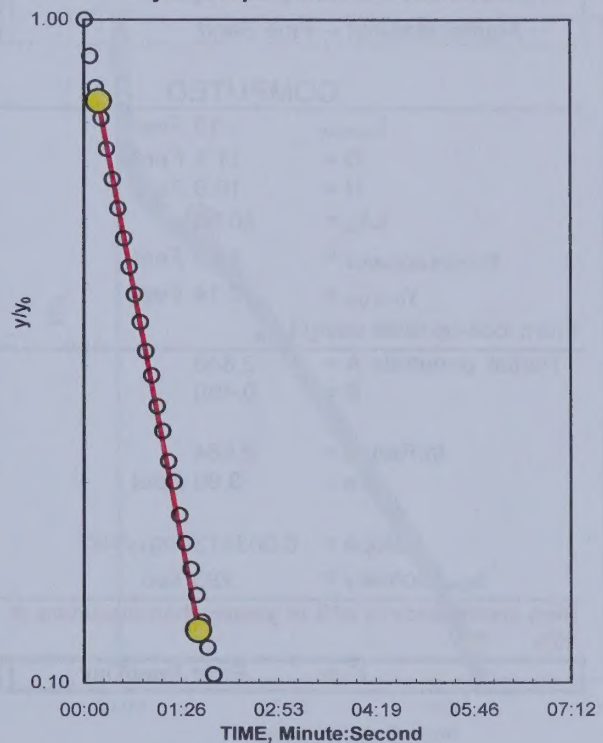
Annular Fill:

across screen -- Coarse Sand
above screen -- Bentonite

Aquifer Material -- Fine Sand



Adjust slope of line to estimate K



COMPUTED

L_{wetted}	10 Feet
$D =$	11.1 Feet
$H =$	10.6 Feet
$L/r_w =$	30.00
y_0 -DISPLACEMENT =	4.59 Feet
y_0 -SLUG =	6.14 Feet

From look-up table using L/r_w

Partial penetrate A =	2.514
B =	0.414
$\ln(Re/r_w) =$	2.455
Re =	3.88 Feet

Slope =	0.008967 $\log_{10}/\text{sec}$
$t_{90\%}$ recovery =	112 sec

Slug discrepancy of 29% is greater than maximum of 20%

K = Error Feet/Day

K= 1.5 is less than likely minimum of 3 for Fine Sand

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

PROJECT: RICHLAND COUNTY OLD LANDFILL

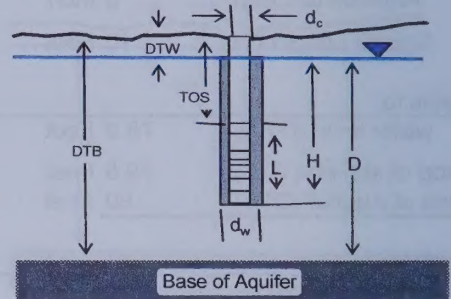
Local ID: SL-4 (Slug-Out)

Date: 11/12/2009

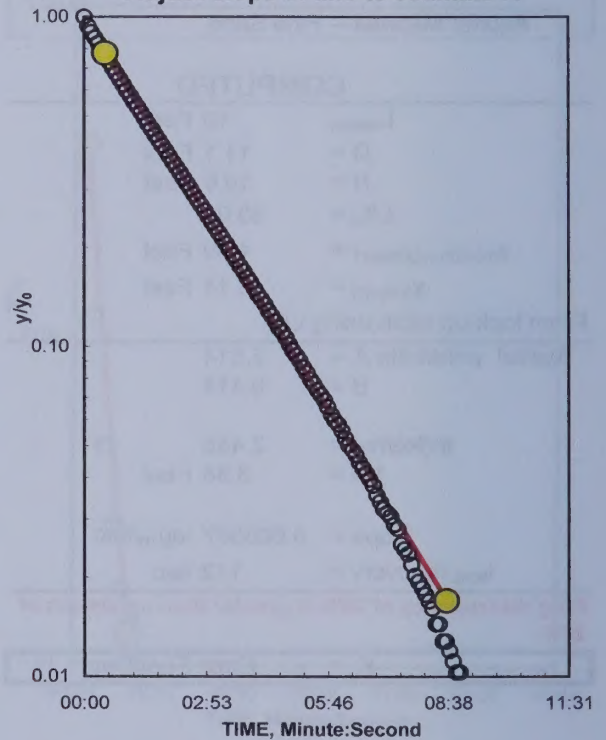
Time: 0:00

INPUT

Construction:	
Casing dia. (d_c)	2 Inch
Annulus dia. (d_w)	6 Inch
Screen Length (L)	10 Feet
Depths to:	
water level (DTW)	78.9 Feet
top of screen (TOS)	79.5 Feet
Base of Aquifer (DTB)	90 Feet
Annular Fill:	
across screen --	Medium Sand
above screen --	Bentonite
Aquifer Material -- Fine Sand	



Adjust slope of line to estimate K



COMPUTED

L_{wetted}	10 Feet
D =	11.1 Feet
H =	10.6 Feet
L/r_w	40.00
y_0 -DISPLACEMENT =	2.43 Feet
y_0 -SLUG =	6.14 Feet
From look-up table using L/r_w	
Partial penetrate A =	2.840
B =	0.460
$\ln(Re/r_w)$ =	2.684
Re =	3.66 Feet
Slope =	0.003413 $\log_{10}/\text{sec}$
$t_{90\%}$ recovery =	293 sec
Slug discrepancy of 87% is greater than maximum of 20%	
K =	Error Feet/Day

K= 0.63 is less than likely minimum of 3 for Fine Sand

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

PROJECT: RICHLAND COUNTY OLD LANDFILL

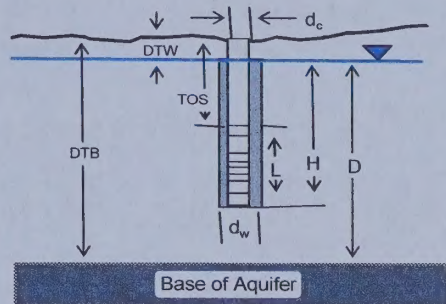
Local ID: SL-5 (Slug-In)

Date: 11/11/2009

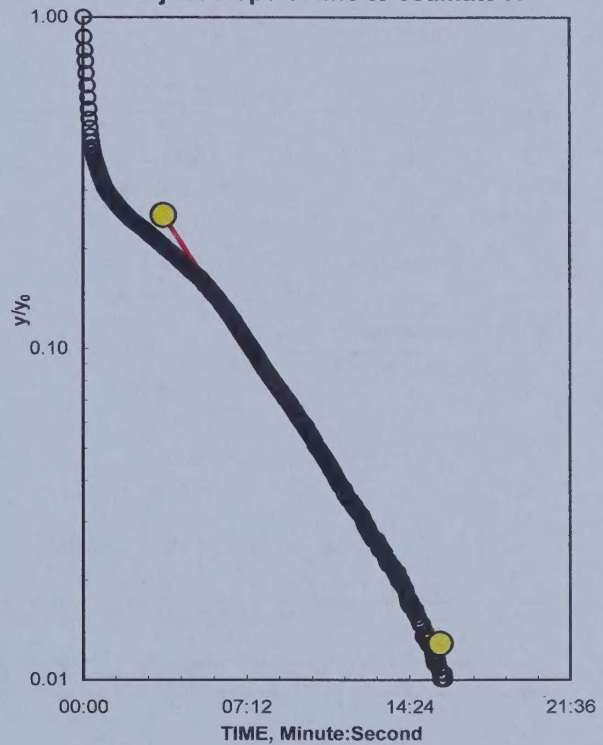
Time: 0:00

INPUT

Construction:	
Casing dia. (d_c)	2 Inch
Annulus dia. (d_w)	8 Inch
Screen Length (L)	10 Feet
Depths to:	
water level (DTW)	85.41 Feet
top of screen (TOS)	85 Feet
Base of Aquifer (DTB)	95 Feet
Annular Fill:	
across screen --	Coarse Sand
above screen --	Bentonite
Aquifer Material -- Silt, Loess	



Adjust slope of line to estimate K



COMPUTED

L_{wetted}	9.59 Feet
$D =$	9.59 Feet
$H =$	9.59 Feet
$L/r_w =$	28.77
$y_0\text{-DISPLACEMENT} =$	5.17 Feet
$y_0\text{-SLUG} =$	6.14 Feet
From look-up table using L/r_w	

Fully penetrate C = 2.026
 $\ln(Re/r_w) = 2.513$
 $Re = 4.12$ Feet

Slope = $0.001765 \log_{10}/\text{sec}$
 $t_{90\% \text{ recovery}} = 567$ sec

Input is consistent.

K = 0.32 Feet/Day

K= 0.32 is greater than likely maximum of 0.1 for Silt, Loess

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

PROJECT: RICHLAND COUNTY OLD LANDFILL

Local ID: SL-9 (Slug-Out)

Date: 11/19/2009

Time: 0:00

INPUT

Construction:

Casing dia. (d_c)	2 Inch
Annulus dia. (d_w)	6 Inch
Screen Length (L)	5 Feet

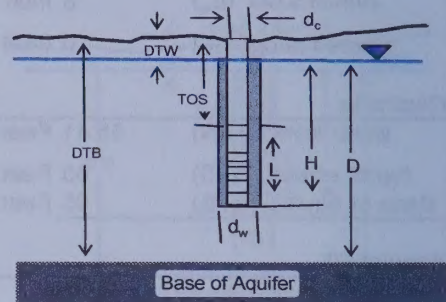
Depths to:

water level (DTW)	35.09 Feet
top of screen (TOS)	39.4 Feet
Base of Aquifer (DTB)	45.5 Feet

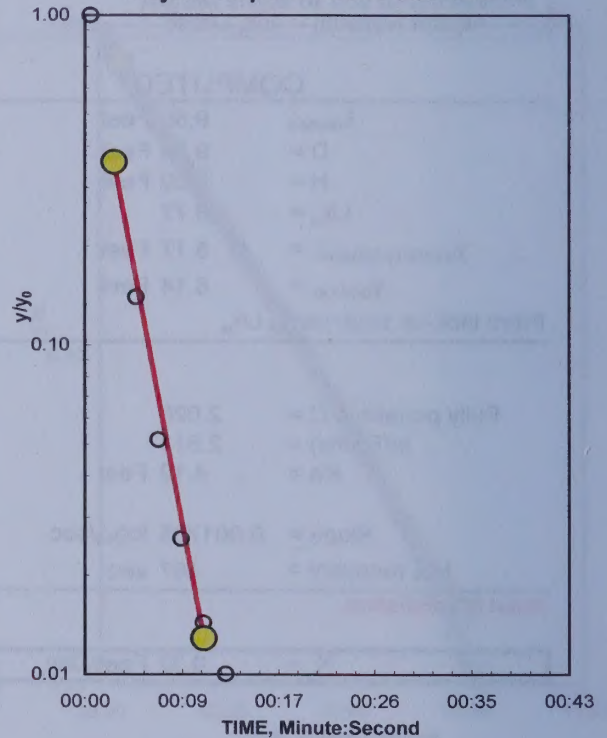
Annular Fill:

across screen -- Medium Sand
above screen -- Bentonite

Aquifer Material -- Gravel



Adjust slope of line to estimate K



COMPUTED

L_{wetted}	5 Feet
D =	10.41 Feet
H =	9.31 Feet
L/r_w	20.00
y_0 -DISPLACEMENT =	1.39 Feet
y_0 -SLUG =	6.14 Feet

From look-up table using L/r_w

Partial penetrate A =	2.202
B =	0.345
$\ln(Re/r_w)$ =	2.274
Re =	2.43 Feet

Slope = 0.181788 $\log_{10}/\text{sec}$

$t_{90\%}$ recovery = 6 sec

K= 57 is less than extreme minimum of 90 for Gravel

K = Error Feet/Day

K= 57 is less than likely minimum of 300 for Gravel

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

Van Oort, Martin

From: Pearson, Mark F. [Mark.Pearson@tetratech.com]
Sent: Tuesday, October 19, 2010 10:24 AM
To: Van Oort, Martin
Cc: Kelly Logan; Russell Huotari; Miller, Kirk
Subject: Richland County Landfill #102 - Report of Investigation and Monitoring Activities - July and August 2010
Attachments: 10-19-10 RCLF Report.pdf

Gentlemen,

Please find the attached final report for your files.

Thank you.

Mark F. Pearson
Project Hydrogeologist

Tetra Tech
851 Bridger Drive, Ste 6
Bozeman, Montana 59715

Office Telephone: 406-582-8780
Cell Telephone: 406-459-4169

10/28/2010



TETRA TECH, INC.

October 19, 2010

Mr. Kelly Logan and Mr. Russell Houtari
Richland County
2140 West Holly Street
Sidney, MT 59270

**RE: Report of Investigation and Monitoring Activities – July and August 2010
Richland County Former Landfill #102
Sidney, Richland County, Montana**

Dear Gentlemen:

Enclosed is a draft report summarizing the results of Tetra Tech's investigation and Richland County's monitoring activities conducted in July and August 2010. Please review this report and feel free to ask any questions or provide comments. Following any edits to this document and approval from you, we can forward this to Martin VanOort, case manager, Montana Department of Environmental Quality. We appreciate the opportunity to work with Richland County on this project.

Sincerely,

Mark F. Pearson
Project Hydrogeologist

Enclosure: Report of Investigation and Monitoring Activities – July and August 2010

851 Bridger Drive, Suite 6 (59715)
P.O. Box 1413 (59771)
Bozeman, MT
Office 406.582.8780
Fax 406.582.8790

Report of Investigation and Monitoring Activities – July and August 2010

**Richland County Former Landfill #102
Sidney, Richland County, Montana**

Submitted to:

Mr. Kelly Leger and Mr. Russell Hodges
Richland County
2740 West Holly Street
Sidney, MT 59270

Submitted by:

True Tech, Inc.
851 Bridge Creek Trail
Bozeman, Montana 59715

October 15, 2010

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FIGURE 2: Site Map

FIGURE 3: Cross Section

FIGURE 4: Data Summary

FIGURE 5: Groundwater Flow

FIGURE 6: Thickness of Soil

FIGURE 7: Topographical Map of Monitoring Well – July 2010

Submitted to:

Mr. Kelly Logan and Mr. Russell Houtari
Richland County
2140 West Holly Street
Sidney, MT 59270

APPENDIX B: TABLES

TABLE 1: Summary of Monitoring Well Specifications and Location

TABLE 2: First Parameter Measurements – July 2010

TABLE 3: Summary of Collected Chemical and Physical Data and Concentrations

APPENDIX C: Drilling Logs

APPENDIX D: Laboratory Reports

Submitted by:

Tetra Tech, Inc.
851 Bridger Drive, Ste 6
Bozeman, Montana 59715

October 19, 2010

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- FIGURE 1 Location Map
- FIGURE 2 Site Vicinity
- FIGURE 3 Cross Section A-A' B-B' C-C'
- FIGURE 4 Top of Fort Union Formation Structure Contour Map
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- FIGURE 6 Thickness of Saturated Interval in Glacial Till
- FIGURE 7 Tetrachloroethene in Monitoring Wells – July 2010

APPENDIX B: TABLES

- TABLE 1 Summary of Monitoring Well Specifications and Lithology
- TABLE 2 Field Parameter Measurements – July 2010
- TABLE 3 Summary of Selected Chlorinated Solvent Compound Concentrations

APPENDIX C: Drilling Logs

APPENDIX D: Laboratory Reports

1.0 INTRODUCTION

This document presents methods and results of Tetra Tech's continued groundwater investigations and Richland County's monitoring activities for Richland County in July and August 2010 at the former Richland County Landfill #102 (site, **Figure 1**). The objective of continued investigation was to evaluate the downgradient extent of tetrachloroethene-impacted groundwater north of the former landfill. The groundwater investigations were conducted in accordance with Tetra Tech's *Proposal for Additional Investigation and Monitoring Activities* and Consulting Services Agreement dated May 17, 2010.

The July 2010 investigations included drilling and completion of six monitoring wells north of the former landfill. Richland County personnel conducted monitoring and sampling of the monitoring wells in July 2010. Samples were submitted for laboratory analysis of volatile organic compounds (VOCs). Richland County personnel also measured water levels in monitoring wells during August 2010.

Figures and tables are contained in **Appendix A** and **B**, respectively. Drilling logs are contained in **Appendix C**. Laboratory reports are contained in **Appendix D**.

1.1 BACKGROUND INFORMATION

This section has been updated to include the findings resulting from drilling, installation, and sampling of monitoring wells SL-6 through SL-9. These activities occurred in November and December 2009 (Tetra Tech 2010).

The site is located about three miles north of Sidney, Montana (**Figure 1**) and is comprised of the former landfill, approximately 80 acres and agricultural land up to approximately 2,500 feet north of the former landfill. The site is in the south half of Section 8, Township 23 North, and Range 59 East, Richland County, Montana.

Topography

The site is located on an upland terrace approximately 250 feet above and northwest of the Yellowstone River valley at an average elevation of 1,990 feet above mean sea level (AMSL). The landfill is situated on a topographic high and drainages trend to the southeast and northwest, away from the landfill. Total relief at the site is approximately 90 feet. The general aspects of the site and vicinity are shown in **Figure 2**.

Climate

Climate of the site is by characterized long, cold winters and short, cool summers. The average annual temperature at Sidney, three miles south of the site is 42 degrees Fahrenheit. Average annual precipitation is 14 inches and the average annual evaporation is approximately 33 inches.

Land Use

Land use is primarily livestock grazing and farming. Property to the east and southeast of the site is rural residential. Six occupied residences are located within one-half mile of the site to the east and southeast.

Domestic and Stockwater Wells

Domestic and stock water supply wells within a two mile radius of the site indicate that most of the wells are completed in the Fort Union formation. The Montana Bureau of Mines Groundwater Information Center (GWIC) database indicates that there are eight water supply wells within a half mile of the landfill. These are in an east and southeast direction from the landfill. Most wells are reportedly completed in the Fort Union formation at depths of 100 to 200 feet below ground surface.

There were two water supply wells, 8-0 and 8-1 completed in the Fort Union formation within the landfill boundaries. Well 8-0 was reportedly 107 feet deep and well 8-1 was reportedly 200 feet deep. Well 8-1 was screened from 166 to 200 feet and had a static water level of 73 feet in April 1990. There is no record of completion of well 8-0 (Damschen and Assoc. 1990). Domestic/water supply well locations adjacent to the landfill are shown in **Figure 2**.

Historic Landfill Operations

Landfill operations began at the site in 1970 and ceased in October 1995. The City of Sidney operated the landfill between 1970 and 1981. Richland County assumed operations after 1981. Previous reporting of the site indicated that landfill operations were conducted with little planning and no record keeping of where waste was placed over time (Damschen & Associates 1990).

In 1985, the Richland County excavated and began landfill operations in the first of two deeper waste cells (referred to as the Deep Cells) in the northwestern part of the landfill property. The location of the Deep Cells area is shown in **Figure 2**. The Deep Cells area consists of two large trenches, each approximately 225 feet wide in an east-west dimension and 550 feet in a north-south dimension. The first cell was excavated, in the west half of the Deep Cells area, to a depth of approximately 40 feet, and filled with refuse. During excavation and landfiling, groundwater was intercepted at the south margin of the first cell. Therefore, the second cell was excavated to a shallower depth (25 feet) to avoid interception with groundwater. The second cell was located in the east half of the Deep Cells area, parallel to the first cell. Refuse was accepted into the Deep Cells area until 1995.

Closure activities were conducted between 1993 and 1996. DEQ required that the entire landfill property be capped as part of closure operations. Clayey soil was excavated from a 40 acre area north of well SL-3 and west of well SL-4 (in the vicinity of well SL-9) to be used as a cap over the landfilled refuse. This clayey material was spread over the entire landfill property to a thickness of approximately two feet (Kelly Logan, Richland County Sanitarian, personal communication, May 2010). The eastern two thirds of the landfill was capped in 1993 and the western edge (one sixth) of the landfill was capped in 1994 (Richland County, 2009). The Deep Cells area was capped in 1995. Closure activities also included re-contouring (prior to capping) and revegetation.

Geology

Unconsolidated deposits of gravel, sand, sandy clay, silt, and clay underlie the land surface in the site vicinity. These deposits mantle most of the bench land northwest of the Yellowstone River and have been removed by erosion in incised drainages. These unconsolidated deposits or sediments are defined as glacial outwash (John Reiten, Montana Bureau of Mines and

Geology, personal communication, April 2010) and have also been classified as glacial till of Quaternary age (Qgt; Montana Bureau of Mines and Geology 2003).

Drilling sample descriptions in monitoring well logs SL-1 through SL-9 indicate that the glacial till varies in thickness between 26 feet (well SL-1) and 91.5 feet (well SL-5). Between wells SL-1 to SL-4 and SL-5 (northward) there is an increase in thickness of the glacial till and this coincides with a topographic high in the northern portion of the landfill property. Also, downslope to the north, wells SL-6 and SL-7 intercept an average of 79 feet of glacial till. Wells SL-8 and SL-9 are located adjacent to or in an area that was excavated for landfill cover soil. Intersection with the Fort Union formation was higher in elevation in the vicinity of wells SL-8 and SL-9 so that the glacial till averages only 51 feet in thickness.

No visually distinct organic material was observed in the drilling samples collected from wells SL-1 through SL-9. No staining or unusual odors were detected while logging drill cuttings of these wells.

Early landfill assessment investigations noted glacial till mapped within the landfill boundaries, in backhoe trenches to 41 feet depth. The glacial till in these trenches was observed as sandy material with occasional one foot thick gravel zones. Hydraulic conductivities measured in this material, near surface, averaged 4×10^{-3} centimeters per second (Chen-Northern 1990).

Tertiary age, Tongue River Member of the Fort Union formation (Tftr; Montana Bureau of Mines and Geology 2003) underlies the glacial till. Intersection with Fort Union formation during the drilling of wells SL-1 through SL-9 had been observed as a visually distinct, gray, dense, and moist shale, clay, or claystone after drilling through overlying glacial till, commonly described as a water-saturated sand and gravel. Additional observations of Fort Union formation described it as having a plastic or sticky texture.

Regionally, the Fort Union formation can consist of more than 1,000 feet of sandstone, shale, coal, clay, and clinker beds. The formation is nearly horizontal, with a dip of 0.3% to the northeast in the site vicinity (Montana Bureau of Mines and Geology 2003). Surface exposures of Fort Union formation have been mapped north and south of the site and appear to be exposed in bluffs, valley slopes, and incised drainages.

Examination of elevations (structure contour) of the Fort Union formation intersection in wells SL-1 through SL-5 had suggested a 1% northerly dip. With the addition of four monitoring wells in November 2009, the highest elevation intersection with the Fort Union formation existed in wells SL-1 and SL-8 (1,932 feet AMSL). The elevation of Fort Union formation intersections in wells SL-5 through SL-9 is between 1,921 and 1,932 AMSL. The lowest elevation Fort Union formation intersections are in wells SL-3 and SL-4 (1,917 and 1,919 feet AMSL, respectively). These spatial elevation differences suggest that the contact of Fort Union formation with glacial till dips north and northwest between 0.5 and 1% in the vicinity of wells SL-1 through SL-5 and south up to 2% in the vicinity of wells SL-3, SL-4, SL-8, and SL-9. A Fort Union formation structure contour map including all drilling to date is presented in **Figure 4**.

Hydrogeology

Hydrologic features in the vicinity of the site include the Yellowstone River located three miles to the southeast, Lone Tree Creek located three miles to the south, and several unnamed

ephemeral creeks and springs. The Yellowstone Project irrigation canal is located approximately one mile southeast of the site (**Figure 1**).

Two distinct water bearing units, exist in the site vicinity. The uppermost water bearing interval is hosted in glacial till sediments. This water bearing interval has also been described as an "upper" or "perched" water bearing unit occurring in the basal portion of the glacial till formation. The second water bearing unit actually consists of multiple water bearing intervals within the Fort Union formation. The glacial till water bearing interval exhibits impacts from historic landfill operations. This occurs as volatile organic compounds (VOCs), dissolved in groundwater, originating within and adjacent to the landfill.

The underlying Fort Union formation appears to be a relatively impermeable base or aquiclude to the glacial till water bearing interval. Drilling and monitoring data in wells SL-1 through SL-9 indicates that the saturated thickness of the water bearing interval in the glacial till (intersection of groundwater to the intersection with the Fort Union formation) is between one and 16 feet (**Table 1**).

Water bearing intervals within the Fort Union formation occur in sandstone, coal and clinker beds. The majority of water supply wells in the vicinity of the landfill are completed in Fort Union formation. Well completions are reported to be a minimum of approximately 100 feet below ground surface, have static water levels 20 to 250 feet below ground surface, and yield between two and 20 gallons per minute (Montana Bureau of Mines GWIC 2010). Published, regional groundwater potentiometric contours/flow directions indicate groundwater flow in the Fort Union formation aquifer(s) is to the southeast in the site vicinity (USGS 1984).

Three springs, designated as S-3, S-5, and Almond Spring have been identified within one mile of the landfill. The locations of these springs are shown in **Figure 2**. These have been included in the landfill's groundwater monitoring program. Spring S-3 is located approximately one mile north of the site and discharges from a coal seam at a rate of approximately 10 gallons per minute (gpm). Spring S-5 discharges from the base of gravel deposits, about 800 feet southeast of the site, at a rate of 1 to 2 gallons per minute. Almond Spring has an estimated discharge of one gallon per minute (Kelly Logan, Richland County Sanitarian, personal communication, May 2010).

Prior to installation of additional monitoring wells, groundwater flow direction had been difficult to calculate between wells SL-1 through SL-5. This was due to the wells' spacing and well SL-1 having a greater fluctuation of groundwater elevations compared with wells SL-2 through SL-5. There is approximately two feet of groundwater elevation difference between these wells. An initial interpretation of the data suggested the existence of a groundwater divide trending northeast-southwest, within the landfill boundaries. However, with the installation of wells SL-6 through SL-9, groundwater flow direction was interpreted to be generally to the north. Specifically, groundwater appears to flow northeast, from the Deep Cells toward well SL-4 and then turn north toward well SL-7 under a gradient of approximately 0.1%. The Richland County 2010 monitoring report also indicated an easterly groundwater flow between wells SL-1 and SL-2 under a gradient of approximately 0.17%.

Aquifer slug tests were performed on monitoring wells SL-2 through SL-7 and SL-9 in November 2009. Calculated hydraulic conductivities were between 0.27 and 57 feet per day. In the north part of the landfill and site, hydraulic conductivity in wells SL-3 through SL-9 average 13.7 feet per day and the median is 5.8 feet per day. Assuming the highest hydraulic conductivity measured,

57 feet per day, 0.002 foot/foot groundwater gradient, 0.35% porosity, and entry of the contaminant into the water bearing interval (hosted by the glacial till) in 1985 (beginning of landfill waste acceptance in the Deep Cells); the contaminant plume could have potentially traveled approximately 3,000 feet from its source (Tetra Tech 2010).

Monitoring and Corrective Measures Activities

Environmental monitoring of the landfill began in 1990. Additional groundwater monitoring events were conducted through 1995 and indicated concentrations of volatile organic compounds (VOCs), specifically tetrachloroethene (also referred to as PCE), exceeding the groundwater protection standard (GPS).

The water bearing interval in the basal portion of the glacial till formation has been the focus of investigation for PCE-impacted groundwater migrating, in a northerly direction, off the landfill property. This glacial till water bearing interval is a water table aquifer, i.e., not under any significant hydrostatic pressure when intersected during drilling. Groundwater contour maps prepared using groundwater level data in wells SL-3 through SL-9 indicated groundwater flow to the north and possibly northeast. Observations in the drilling indicate that Fort Union formation is the aquiclude to the glacial till water bearing interval. The assumption has also been that a significant section of Fort Union formation separates the glacial till water bearing unit with deeper aquifers hosted in Fort Union formation.

Analysis of this data in consideration of the Administrative Rules of Montana landfill regulations indicated that the preparation of a corrective measures assessment (CMA) was necessary. The CMA was completed in 1996 (Maxim Technologies 1996). Richland County selected a no action alternative in the CMA but this alternative was not approved by DEQ. Therefore, the county proposed installation of a passive venting system to mitigate subsurface accumulation of landfill gas and infiltration of waste leachate containing VOCs to the groundwater. The passive venting system (also referred to as the passive methane extraction system) was approved by DEQ in 2000 and installed during November 2001 (Kelly Logan, Richland County Sanitarian, personal communication, May 2009).

The passive methane extraction system has been installed in the Deep Cells area and another deeper waste cell area to the south, as shown in **Figure 2**. The venting systems consists of horizontally buried networks of 6-inch diameter, polyvinyl chloride (PVC) perforated piping with 10 PVC blank (casing) vertical pipes fitted with wind turbine ventilators. The extent of the piping network is approximately 350 feet in an east-west dimension and 450 feet in a north-south dimension, centered over the Deep Cells area. The horizontal piping is approximately two feet below the ground surface. There has been no history of gas monitoring of the system in terms of air flow velocities, VOC, methane, oxygen, carbon dioxide concentrations, etc., to determine effectiveness/performance of the system.

The network of groundwater monitoring wells (all wells installed to date) is shown in **Figure 2**. The first three monitoring wells, SL-1 through SL-3 were installed in 1990. In 1994, an additional two monitoring wells, SL-4 and SL-5, were installed to better delineate the extent of VOCs in groundwater in the perceived downgradient direction of the landfill. VOCs were detected in well SL-4 but not SL-5. The groundwater and surface water monitoring program has included the sampling of a 25 foot deep, hand-dug water supply well on the Lamphier property east of the landfill, two springs (S-3 and S-5), and the five monitoring wells (SL-1 through SL-5).

Routine compliance monitoring is conducted on a semi-annual basis for parameters listed in Table 1 of ARM 17.50.708. The December 2009 monitoring results indicated concentrations of PCE exceeding the GPS. Other VOCs detected in site monitoring wells include chloroform; 1,1-dichloroethane; cis-1,2-dichloroethene; trichloroethene; and dichloro-difluoromethane (Freon-11). Apart from PCE exceeding the regulatory standard, concentrations of barium in well SL-3 and nitrate+nitrite in wells SL-1 and SL-4 have also exceeded regulatory standards.

Methane Monitoring

Methane monitoring is conducted on a quarterly basis in all of the monitoring wells and four methane monitoring wells (designated LG-1 through LG-4 in shown in **Figure 2**) within the boundary of the landfill. The methane monitoring wells were drilled between 20 and 25 feet depth. Monitoring results show that only well SL-1 had measurable concentrations of methane which was initially 100% in 1995 and decreased to 34 percent in September 2008.

1.2 INVESTIGATION AND MONITORING METHODS

This section describes methods used to drill and install monitoring wells SL-10 through SL-15 and monitor groundwater at the site. Results of these activities are presented in Section 2.0. Figures and tables are contained in **Appendix A** and **B**, respectively. The drill hole logs of wells SL-10 through SL-15 are contained in **Appendix C**. Laboratory reports of monitoring conducted in late July 2010 are contained in **Appendix D**.

1.2.1 Monitoring Well Installation

Six boreholes (also referred to as borings), SL-10 through SL-15, were advanced and completed as monitoring wells north of the northern landfill boundary (**Figure 2**) using Haz Tech Drilling based in Billings, Montana. Haz Tech used a BK-81 hollowstem auger drilling rig. The hollowstem augers prevented the borehole from collapsing. Samples were collected in a three inch (outer diameter), 1.5 foot long split spoon that was driven ahead of the deepest auger. Split spoon samples were collected every five feet in each drill hole.

Monitoring wells were completed with 2-inch diameter, Schedule 40 PVC blank and machine-slotted piping (0.020-inch slot size) with threaded joints. A PVC threaded, end-point was placed at the end of the PVC slotted piping of each well. Filter pack around the well screen consisted of 10/20 silica sand. The borehole around the PVC casing, above the screen, was filled with 3/8 inch bentonite chips to within a couple feet of the surface. Wells were finished as a stickup completion and have locking, steel, well protectors secured with concrete grout. Finally, the new monitoring wells were developed with a stainless steel bailer. The bailer was decontaminated with a Liquinox® solution and deionized water between wells. The use of an electric pump was attempted but could not be used due to the depth to groundwater, relatively small saturated intervals, and slow recoveries.

Note that monitoring wells SL-1 through SL-15 can also be referred to as borings when describing information gained prior to well completion.

1.2.2 Groundwater Monitoring

Groundwater monitoring data used in this report was collected by Richland County personnel in July and August 2010. Monitoring is typically conducted semi-annually and as in previous

monitoring events, the July and August 2010 data will be reviewed, compiled, and reported to DEQ by Richland County personnel. General procedures used by Richland County personnel at each monitoring well, were to measure depth to groundwater followed by purging of the well using a disposable bailer. A sample was collected for laboratory analysis after three well casing volumes had been purged. Samples collected from wells SL-6 through SL-14 in July 2010 were preserved with hydrochloric acid, and submitted for laboratory analysis of volatile organic compounds (VOCs, EPA Method 8260). During and after sampling, Richland County personnel used a downhole multi-meter to measure temperature, pH, specific conductivity (SC), dissolved oxygen (DO), and oxidation reduction potential (ORP).

2.0 DATA PRESENTATION AND ANALYSIS

The drilling, completion, and monitoring of six additional monitoring wells north of the landfill during July and August 2010 added to the knowledge base of the site and afforded a revision of the conceptual models pertaining to site hydrogeology. Data presented in the foregoing sections summarizes aspects of site geology, groundwater occurrence and movement, and groundwater quality with respect to chlorinated solvent concentrations, specifically tetrachloroethene (also referred to as PCE). The data presentation and analysis presented here pertains primarily to the northern portion of the landfill and north of the landfill where the six new monitoring wells are located.

2.1 SITE GEOLOGY

As with the previous drilling, borings SL-10 through SL-15 were drilled through glacial till sediments and terminated when groundwater and the Fort Union formation were intersected. These borings drilled through 30 to 70 feet of glacial till. Borings SL-3 through SL-6 have the greatest thickness of glacial till intercepted, 84 to 93 feet thickness (**Table 1** and **Appendix C**). Wells SL-10, SL-13, and SL-14 were drilled through 60 to 70 feet of glacial till. The glacial till intercepted in the July 2010 drilling was similar to previous drilling at the site and consists of sandy clay, silt, sand, and gravel with sand, silt, and/or small amounts of clay. Several stringers (usually one inch thick or less) of carboniferous (organic) material were observed in the following borings: SL-10 at 20.5, 35, and 63 to 65 feet depth; SL-13 at 64.5 feet depth; and SL-15 at 15.5 feet depth.

Following review of all the glacial till sample descriptions in the drill hole logs, it appears that the glacial till material can be divided into two facies at the site: a 'silt and sand' interval overlying a 'sand and gravel' interval. In previous reporting, these facies were referred to as silty sand and sandy gravel after the drilling and completion of wells SL-1 through SL-3 (Chen-Northern 1990). The 'silt and sand' interval can have varying amounts of silt and sand with minor clay and scattered gravels. The 'sand and gravel' interval is characterized by an increase in gravel (compared with the overlying 'silt and sand' interval) and varying amounts of sand, silt, and minor clay. Review of drill hole logs indicated that the break between these two facies is between 1,941 and 1,957 feet AMSL or an average of 1,950 feet AMSL. The cross-sectional relationship between the two general facies, groundwater depth, and intersection with Fort Union formation is presented in **Figure 3**.

The Fort Union formation was described in borings SL-10 to SL-15 as follows:

SL-10, SL-11, SL-14: gray/light gray, dense, slightly moist shale

SL-12: light yellow-brown to green-brown clay grading downward into gray, dense, moist silt

SL-13: green-gray, hard, flinty shale with radiating pyrite or marcasite crystals

SL-15: green-gray with oxidation fronts, dense, moist silt

These observations are comparable to gray, moist shale observed at the intersection with Fort Union formation in the drilling of borings SL-6 to SL-9 (Tetra Tech 2010). These observations are also comparable to observations of Fort Union formation as a gray claystone in boring SL-3 and blue gray, plastic clay with minor amounts of silt and sand in borings SL-1, SL-2, SL-4, and SL-5 (Chen-Northern, Inc. 1990).

Drill hole intersections of Fort Union formation when plotted in elevations AMSL indicate a gentle 'hill and valley' topography as described in Section 2.1. A Fort Union formation structure contour map is presented in **Figure 4**. This structure contour map is inferred to depict a pre-glacial till, erosional surface of Fort Union formation with maximum relief of approximately 19 feet at the site. Review of all drilling at the site indicates that borings SL-3 and SL-4 intersected Fort Union formation at its lowest elevations (1,917 and 1,919 feet AMSL) and borings SL-1, SL-8, and SL-12 intersected Fort Union formation at its highest elevations (above 1,930 feet AMSL). The structure contour map (**Figure 4**) depicts a valley where borings SL-3 and SL-4 are located. **Figure 4** also indicates a 'ridge' or 'hill' of Fort Union formation beginning near boring SL-8 and extending northwest past boring SL-12. The steepest part of this 'hill' is between borings SL-4 and SL-8 where there is 13 feet of relief in approximately 400 feet. There is a relatively broad and flat area in the vicinity of borings SL-2, SL-5 through SL-7, and SL-10. South of borings SL-3 through SL-5, Fort Union formation slopes upward to higher elevations intersected in borings SL-1 and SL-2. The beginnings of two other 'valleys' are also indicated in borings SL-13 and SL-14 where there are lower elevation Fort Union formation intersections.

2.2 GROUNDWATER OCCURRENCE AND MOVEMENT

Groundwater was intercepted in wells SL-10 through SL-14. Well SL-15 did not encounter groundwater. August 2010 depth to groundwater measurements in wells SL-10 through SL-14 was between 37.9 feet (well SL-12) and 66.5 feet (well SL-10). Groundwater depths ranged between 28.5 feet and 85.1 feet for all of the wells and groundwater elevations ranged between 1,929.9 feet AMSL (well SL-12) and 1,935.5 feet AMSL (well SL-1) during August 2010. Overall, the magnitude of groundwater elevation change across the site was 5.6 feet. Depth to groundwater and calculated groundwater elevations are shown in **Table 1**.

Groundwater contours indicate groundwater flow ranging between northeast to northwest within the landfill boundaries. Groundwater elevations in site monitoring wells for August 2010 are presented in **Figure 5**. North of the landfill, groundwater contours indicate an overall northerly groundwater flow. Starting from the Deep Cells waste, groundwater flow appears to be towards well SL-4, then towards well SL-7, and then towards well(s) SL-12 and/or SL-14. A 'hill' of Fort Union formation in the vicinity of wells SL-8 and SL-12 may impede and divert groundwater flow. The bending of groundwater contours in the vicinity of wells SL-8 and SL-4 indicate groundwater flow being diverted northeast around the 'hill' (**Figure 5**).

Groundwater gradients appear variable and location specific at the site. The groundwater contour map indicates groundwater flow to the north and northeast within landfill boundaries under an

approximate gradient of 0.24%. Groundwater flow is to the north-northwest in the vicinity of wells SL-3, SL-9, and SL-13 under an approximate gradient of 0.23% and northeast in the vicinity of well SL-4 under an approximate gradient of 0.13%. Groundwater flow appears to change from a northeast and northerly flow to a northwest flow in the vicinity of well SL-7 under an approximate gradient of 0.15%. Groundwater contours in the vicinity of wells SL-11, SL-12, and SL-14 indicate a northwesterly flow under a gradient of 0.22%.

Thickness of the water bearing interval in the glacial till, as measured in site monitoring wells during August 2010, ranged between zero (well SL-15) and 16.1 feet (well SL-3). Thickness of the glacial till, water bearing interval was calculated as the difference between the August 2010 groundwater elevations minus the elevation of the intersection with the Fort Union formation in the monitoring wells. Saturated interval thickness for each monitoring well is given in **Table 1**. A map depicting thickness of the glacial till, water bearing interval across the site, prepared from drill hole and groundwater monitoring information, is presented in **Figure 6**. **Figure 6** indicates that the water bearing interval in the glacial till is of greatest thickness in the vicinity of wells SL-3 and SL-4 (13.7 and 16.1 feet, respectively) and thins to the south and north of these wells. Variation in the thickness of the water bearing interval is attributed to the Fort Union formation creating a 'hill and valley' structure as previously discussed and shown in **Figure 5**. Review of **Table 1** and **Figures 4** through **6** indicates that the change in groundwater elevation, moving downgradient, is always less than the change in elevations of the Fort Union formation structure between wells. This is the case between wells SL-4 and SL-11 where the elevation of the Fort Union formation increases 8 feet and the elevation of groundwater decreases 1.4 feet and between wells SL-7 and SL-12 where the elevation of the Fort Union formation increases 8.8 feet (intersection of groundwater and Fort Union formation) and the elevation of groundwater decreases 2.1 feet.

As previously discussed, observations of samples collected during drilling of the wells indicate that the Fort Union formation is an aquiclude to the glacial till, water bearing interval. However, there appears to be entry of groundwater into the Fort Union formation in the vicinity of well SL-12. This appears to be due to an observed facies change resulting in more porous and transmissive Fort Union formation. The underlying boundary or aquiclude to this saturated zone may be the dense, moist silt noted in the last 0.7 foot of drilling boring SL-12 (see Boring Log SL-12 in **Appendix C**).

Thinning and/or formation change of the water bearing interval may have an effect on physical and chemical aspects of the groundwater. Such a change would include a decrease in groundwater velocity or cessation of groundwater flow as implied between wells SL-11 and SL-15. A potential groundwater chemistry change could occur between wells SL-7 and SL-12 due to departure of groundwater from glacial till into a less porous and transmissive Fort Union formation. An indication of potential groundwater chemistry changes may be reflected in a decrease in dissolved oxygen concentrations between wells SL-7 (0.93 milligrams per liter) and SL-12 (0.1 milligrams per liter) measured during July 2010. The dissolved oxygen measurement in well SL-12 was also the lowest in all site wells (**Table 2**). Therefore, thinning of the water bearing interval and host formation changes may serve as controls in the downgradient migration of PCE-impacted groundwater.

2.3 GROUNDWATER QUALITY

Sampling of groundwater for VOCs was conducted after installation of wells SL-10 through SL-15 in late July 2010. Wells SL-3, SL-4, and SL-6 through SL-14 were sampled. Selected VOC concentrations are presented in **Table 3**. Analytical reports are contained in **Appendix D**.

Consistent with previous monitoring, PCE was detected in wells SL-3, SL-4, and SL-6 through SL-9 in concentrations exceeding the human health standard or groundwater protection standard (DEQ 2008). The concentration of PCE ranged between 7.8 and 26 micrograms per liter ($\mu\text{g/L}$) in these wells. PCE and trichloroethene were not detected in wells SL-10 through SL-14 in the July 2010 monitoring event. Other VOCs were detected in these monitoring wells in July 2010 but were in concentrations close to the analytical reporting limits.

The inferred extent of PCE in the northern part of the site, as detected in the monitoring well network, is shown in **Figure 7**. The highest concentration contours exist around wells SL-4, SL-6, and SL-7. The area of PCE-impacted groundwater is bounded to the northwest, north, and northeast by un-impacted monitoring wells SL-10 through SL-13. The boundary (zero contour) of the PCE plume has been inferred in **Figure 7**.

3.0 SUMMARY AND CONCLUSIONS

The following summarizes data, calculations, and interpretations resulting from the investigations and monitoring in July and August 2010 at the Richland County Landfill #102:

- As with previous drilling, borings SL-10 through SL-15 were drilled through 30 to 70 feet of glacial till and were terminated in the Fort Union formation. The glacial till intercepted in the drilling consists of sandy clay, silt, sand, and gravel with sand, silt, and/or small amounts of clay.
- There appears to be a facies change in the glacial till formation where a 'silt and sand' section overlies a 'sand and gravel' section. The change occurs at an average of 1,950 feet AMSL. The thickness of the 'silt and sand' facies varies with surface topography and thickness of the 'gravel and sand' facies varies with the elevation of interception with the structure of Fort Union formation.
- The structure of the Fort Union formation, as determined in drill hole intersections with this unit, indicate a gentle 'hill and valley' topography with maximum relief of approximately 19 feet at the site. Borings SL-3 and SL-4 intersected Fort Union formation at its lowest elevations (1,917 and 1,919 feet AMSL) and borings SL-1, SL-8, and SL-12 intersected Fort Union formation at its highest elevations (above 1,930 feet AMSL). There is a 'hill' of Fort Union formation beginning near boring SL-8 and extending northwest past boring SL-12. There is a relatively broad and flat area in the vicinity of wells SL-2, SL-5 through SL-7, and SL-10. South of borings SL-3 through SL-5, the Fort Union formation slopes upward to higher elevations intersected in borings SL-1 and SL-2. The beginnings of two other 'valleys' are also indicated in the vicinity of borings SL-13 and SL-14.
- Groundwater flow ranges between northeast to northwest within the landfill boundaries. Groundwater flow is to the north/northwest north of the landfill. Specifically, groundwater flows northeast from the Deep Cells waste area towards well SL-4, then towards well SL-7, and then towards well SL-12 and/or SL-14. Measured groundwater gradients were less than 0.3% in August 2010.
- The 'hill and valley' Fort Union formation structure appears to influence water bearing interval occurrence and thickness in the glacial till. Thickness of this water bearing interval ranges between zero (SL-15) and 14 feet (SL-4). The water bearing interval becomes thinner to the

south and north of the landfill from well SL-4. Thinning of the water bearing interval and host formation changes may affect the downgradient migration of PCE-impacted groundwater.

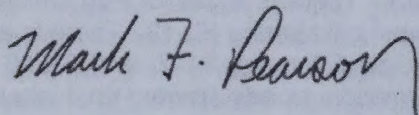
- A saturated interval exists within the upper 16 feet of Fort Union formation in the vicinity of well SL-12 and appears to have correspondence with the water bearing interval hosted in the glacial till to the east and southeast. At all other well locations, Fort Union formation appears to form an aquiclude to the glacial till, water bearing interval.
- Tetrachloroethene (PCE) was detected in wells SL-3, SL-4, and SL-6 through SL-9 in concentrations exceeding the groundwater protection standard. The area of PCE-impacted groundwater is bounded to the northwest, north, and northeast by downgradient and un-impacted monitoring wells SL-10 through SL-13.

4.0 RECOMMENDATIONS

In consideration of the above information, the following recommendations are provided:

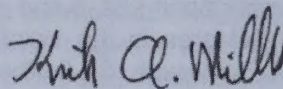
- The corrective measures assessment should be updated with an appropriate corrective measure selected. Richland County officials have expressed a desire to conduct additional corrective measures in the vicinity of the Deep Cells that would potentially decrease chlorinated solvent concentrations in groundwater flowing off of the landfill property. Currently, the corrective measure considered most effective in the Deep Cells area is active landfill gas extraction.
- Groundwater monitoring should be continued semi-annually in wells SL-3 through SL-14 for VOCs until a reliable database is created. In addition, measurement of field parameters and collection of samples for assessment of biodegradation of PCE should be conducted as a pre-corrective measure and for baseline information. Some groundwater biodegradation indicator parameters would include the following: temperature, pH, SC, DO, ORP, chloride, sulfate, nitrate, total organic carbon, iron⁺³, and manganese⁺⁴. Soil gas monitoring could also be conducted in all of the monitoring wells at the site for methane, oxygen, and carbon dioxide.

Prepared by:



Mark F. Pearson
Project Hydrogeologist

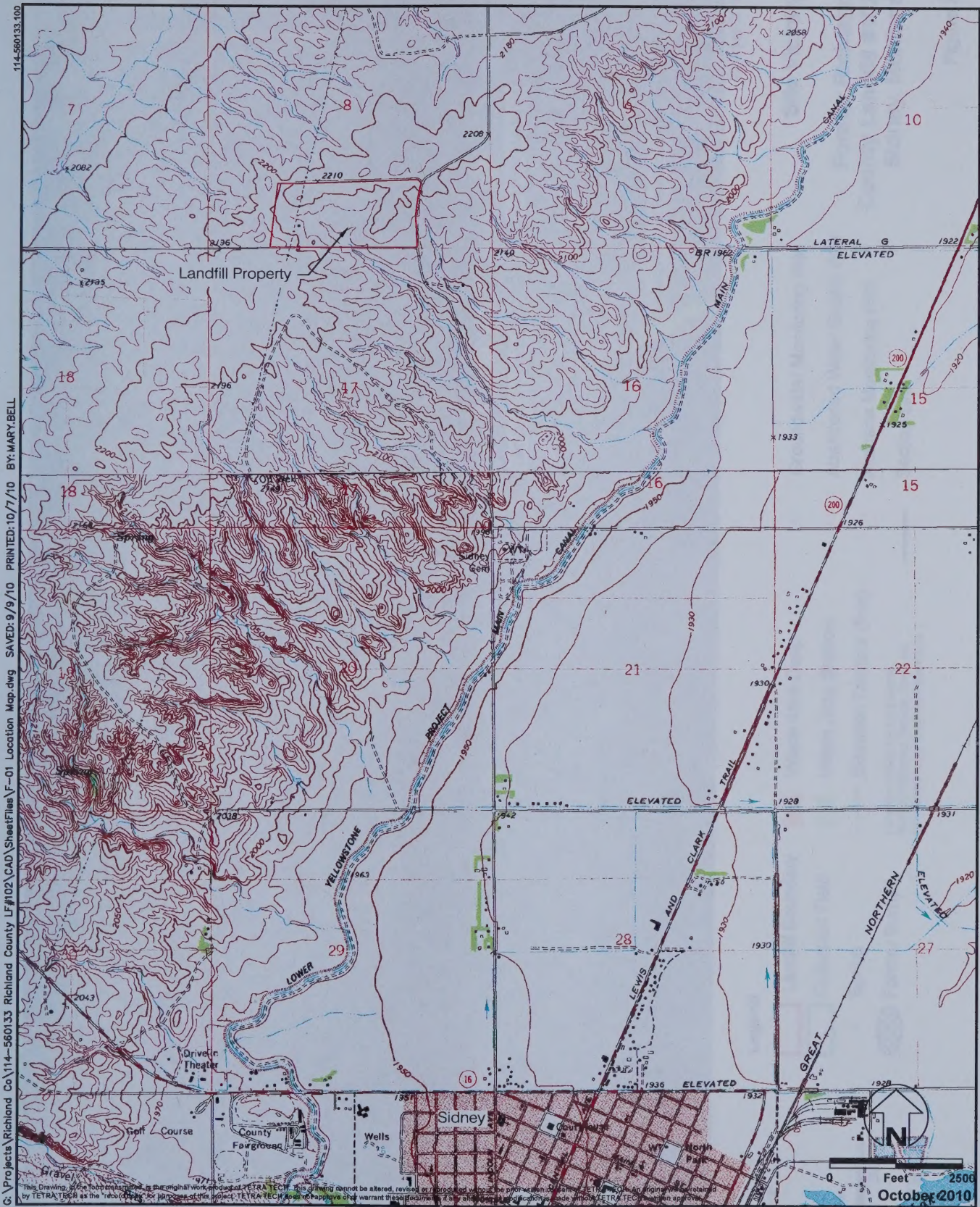
Reviewed by:



Kirk A. Miller
Senior Project Manager

5.0 REFERENCES

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G:\Projects\Richland Co\114-560133 Richland County LF#102\CAD\SheetFiles\F-01 Location Map.dwg
 114-560133.100
 BY: MARY BELL
 PRINTED: 10/7/10
 SAVED: 9/9/10

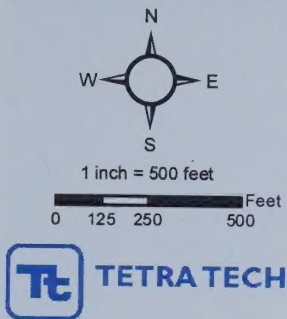
This Drawing, as the 'as-shown' is the original work product of TETRA TECH. This drawing cannot be altered, revised or reproduced without the prior written consent of TETRA TECH. Any reproduction or alteration of this drawing without the prior written consent of TETRA TECH is prohibited. TETRA TECH and its affiliates warrant that the information contained herein is true and correct to the best of their knowledge and belief. TETRA TECH and its affiliates shall not be liable for any damages, including reasonable attorneys' fees, arising out of or from the use of this drawing, whether or not such damages are foreseeable. TETRA TECH and its affiliates shall not be liable for any damages, including reasonable attorneys' fees, arising out of or from the use of this drawing, whether or not such damages are foreseeable.



Location Map
 Former Richland County Landfill #102
 Sidney, Montana
 FIGURE 1



October 2010



Legend

- Landfill Boundary
- Cultivated Field
- Spring
- Former Burnpit

- Waste Area Deep
- Waste Area Shallow
- Elevation Contour (feet)

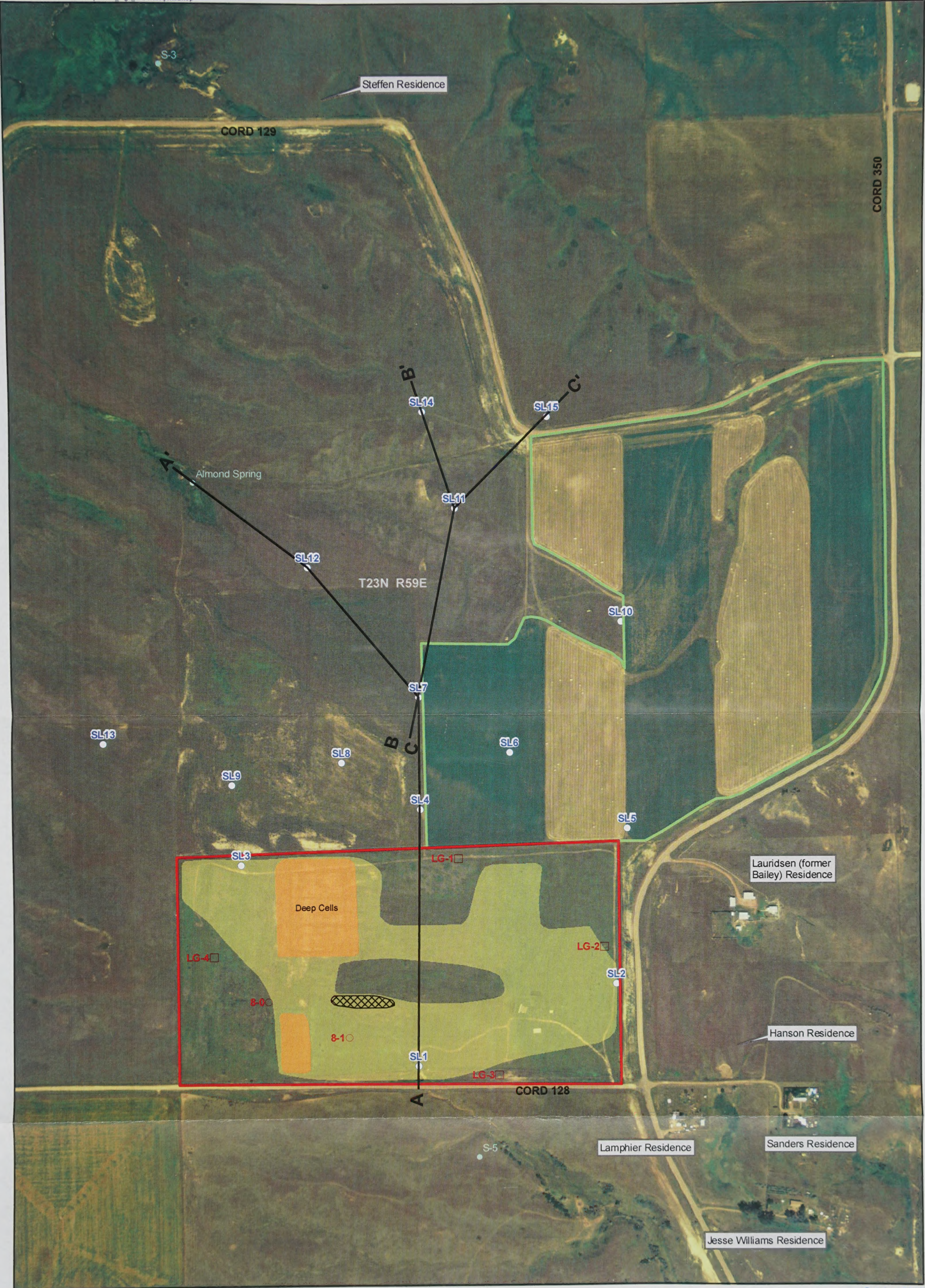
(Source: USGS 1/3-Arc Second National Elevation Dataset. Does not correspond to surveyed well elevations.)

- Groundwater Monitoring Well
- Abandoned Water Supply Well
- Methane Monitoring Well
- Section Line

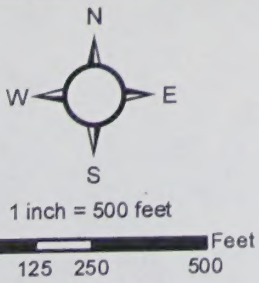
Site Vicinity

**Former Richland
County Landfill #102
Sidney, Montana**

Figure 2



October 2010



Legend

- Landfill Boundary
- Cultivated Field
- Spring
- Former Bumpit

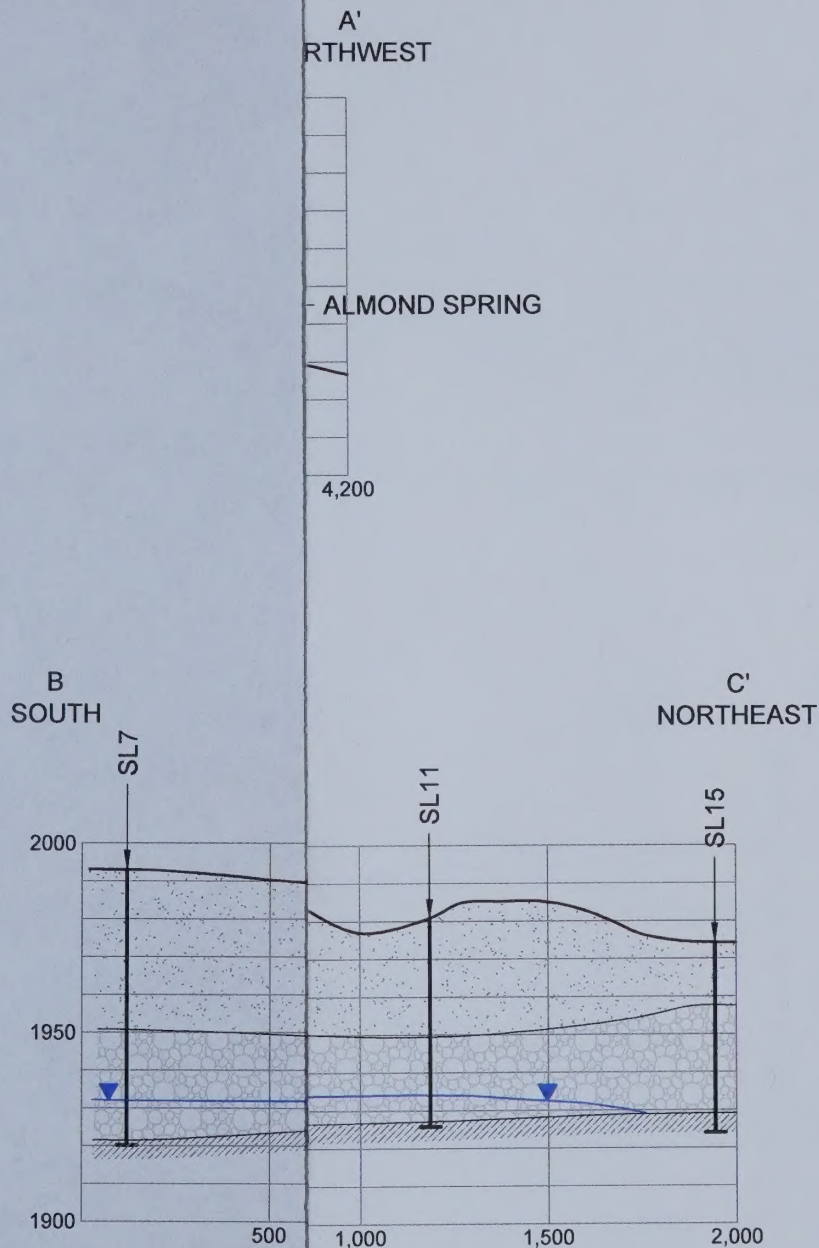
- Waste Area Deep
 - Waste Area Shallow
 - Elevation Contour (feet)
- (Source: USGS 1/3-Arc Second National Elevation Dataset. Does not correspond to surveyed well elevations.)

- Groundwater Monitoring Well
- Abandoned Water Supply Well
- Methane Monitoring Well
- Section Line

Site Vicinity

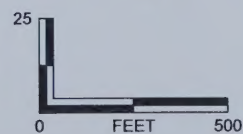
Former Richland
County Landfill #102
Sidney, Montana

Figure 2



Notes:

1. All measurements in feet.
2. The vertical axis is incremented in elevation above me
3. The vertical axis is exaggerated 10 times with respect
4. The site is underlain by unconsolidated deposits mapped as two general lithologies; silt and sand deposits overlying Quaternary Glacial Till overlies the Tertiary Fort Union
5. See Figure 2 for location of cross sections.

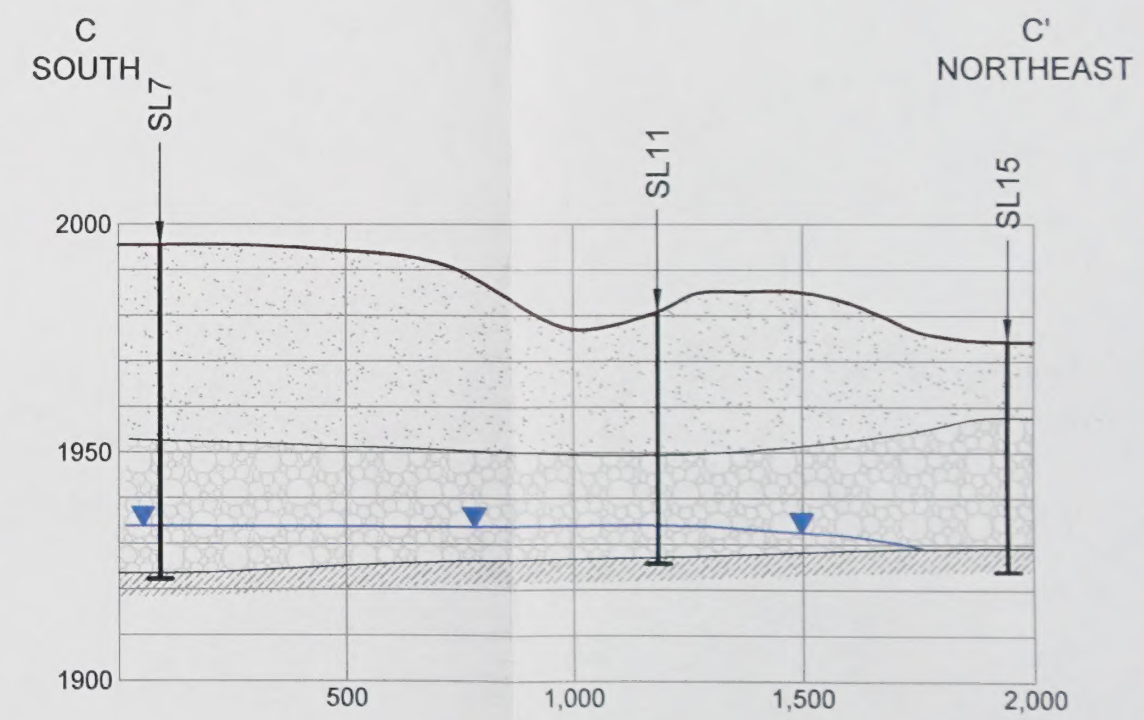
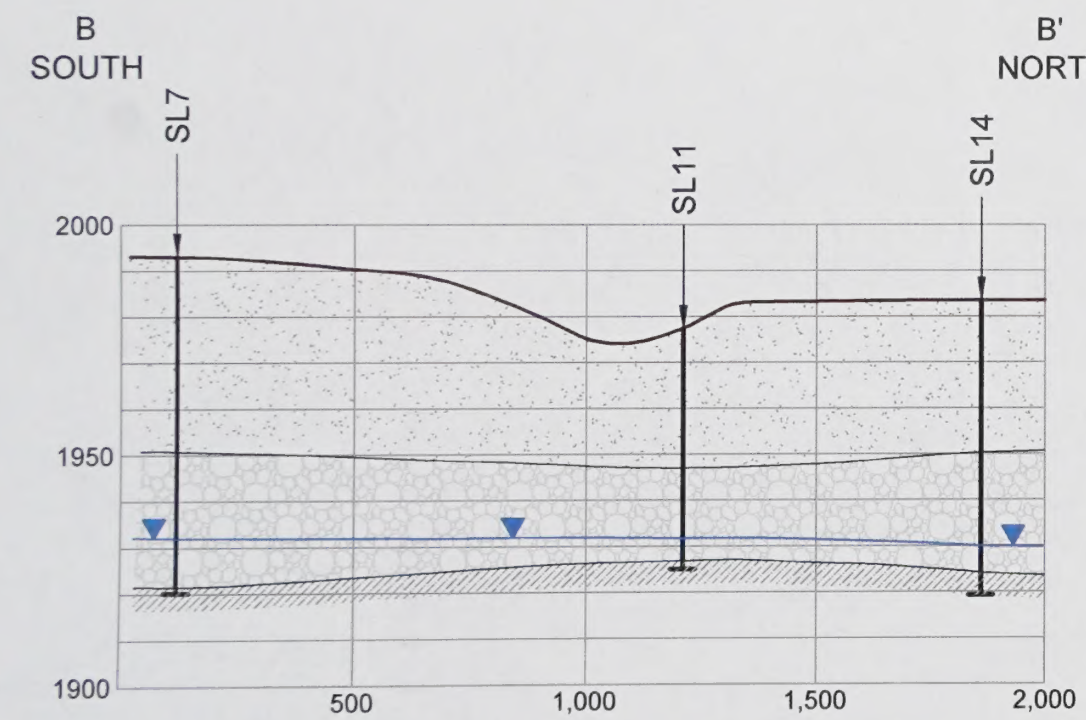
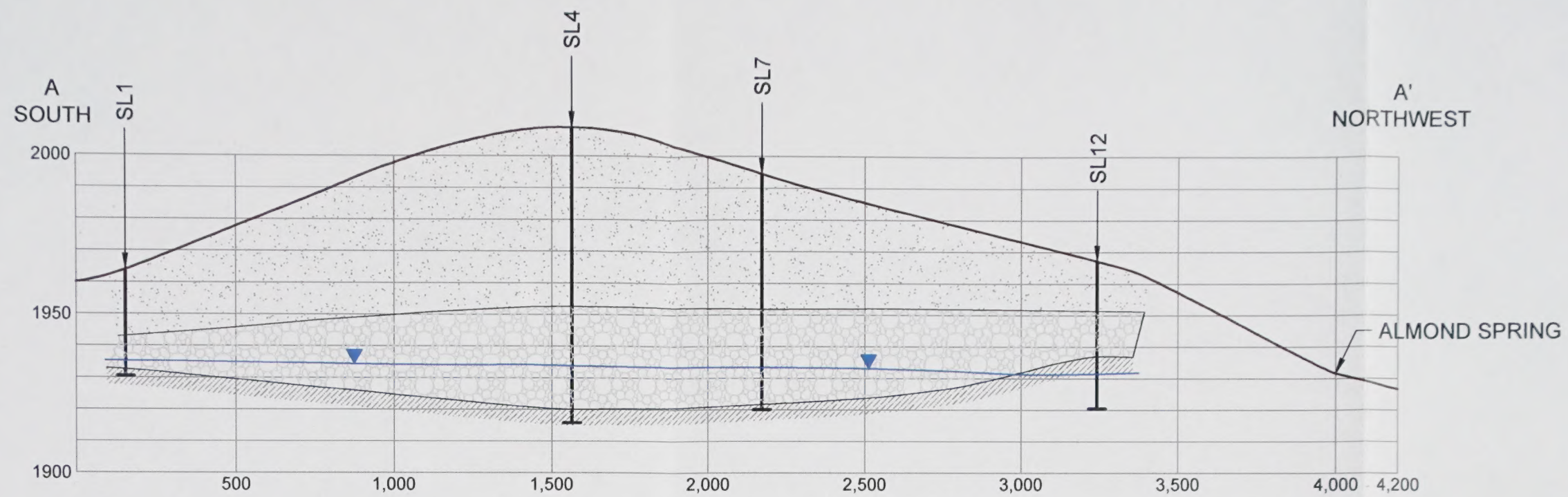


September 2010

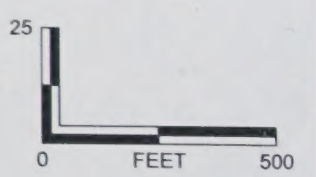
Cross Section A-A' B-B' C-C'

Former Richland County Landfill #102
Sidney, Montana
FIGURE 3

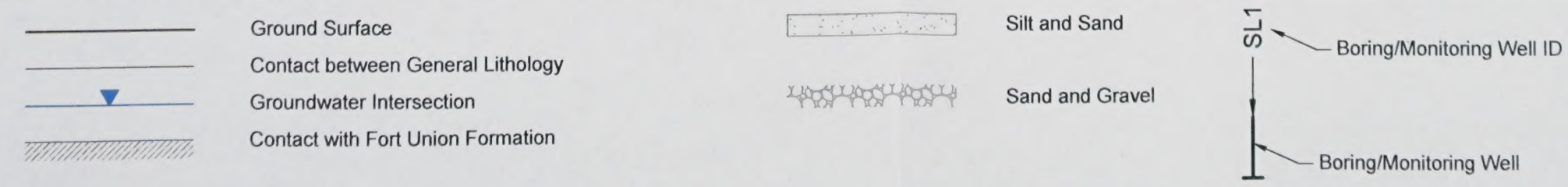




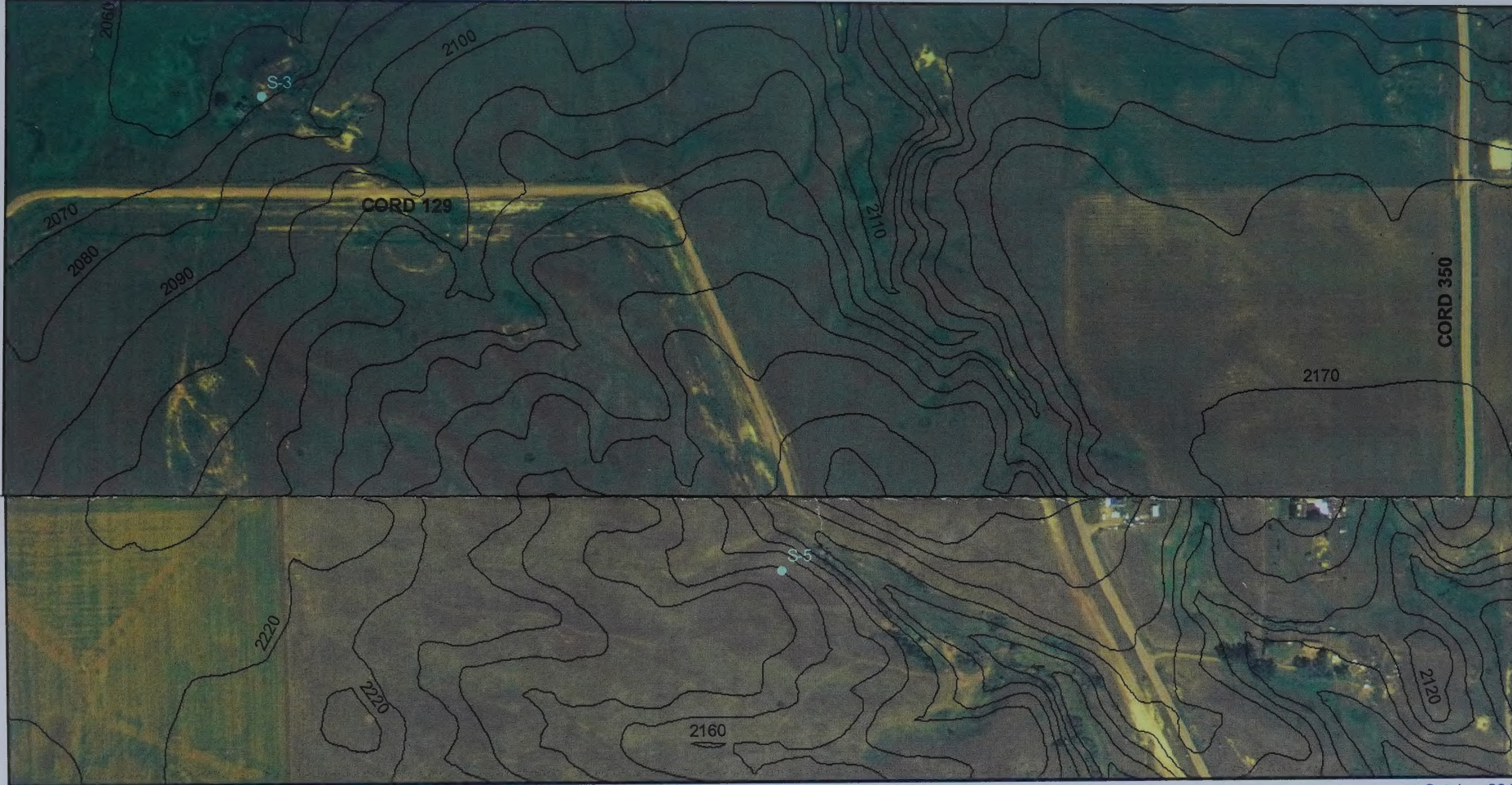
- Notes:
1. All measurements in feet.
 2. The vertical axis is incremented in elevation above mean sea level.
 3. The vertical axis is exaggerated 10 times with respect to the horizontal axis.
 4. The site is underlain by unconsolidated deposits mapped as Glacial Till which consist of two general lithologies; silt and sand deposits overlying sand and gravel deposits. The Quaternary Glacial Till overlies the Tertiary Fort Union Formation.
 5. See Figure 2 for location of cross sections.



September 2010



Cross Section A-A' B-B' C-C'
 Former Richland County Landfill #102
 Sidney, Montana
 FIGURE 3



October 2010

Top of Fort Union Structure Contour Map

**Former Richland
County Landfill #102
Sidney, Montana**

Legend

- Landfill Boundary
- Cultivated Field
- Spring

- + Waste Area Deep
- + Waste Area Shallow
- Elevation Contour
(Feet AMSL: Above Mean
Sea Level)

(Source: USGS 1/3-Arc Second
National Elevation Dataset. Does not
correspond to surveyed well elevations.)

- SL1 Drill Hole/Monitoring Well
- SL2
- 1932 Intersection of Fort
Union Formation
(Feet AMSL: Above Mean Sea Level)
- 1925 Elevation of Intersection of Fort
Union Formation Contour
(Feet AMSL: Above Mean Sea Level)

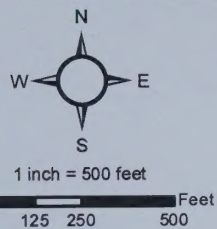
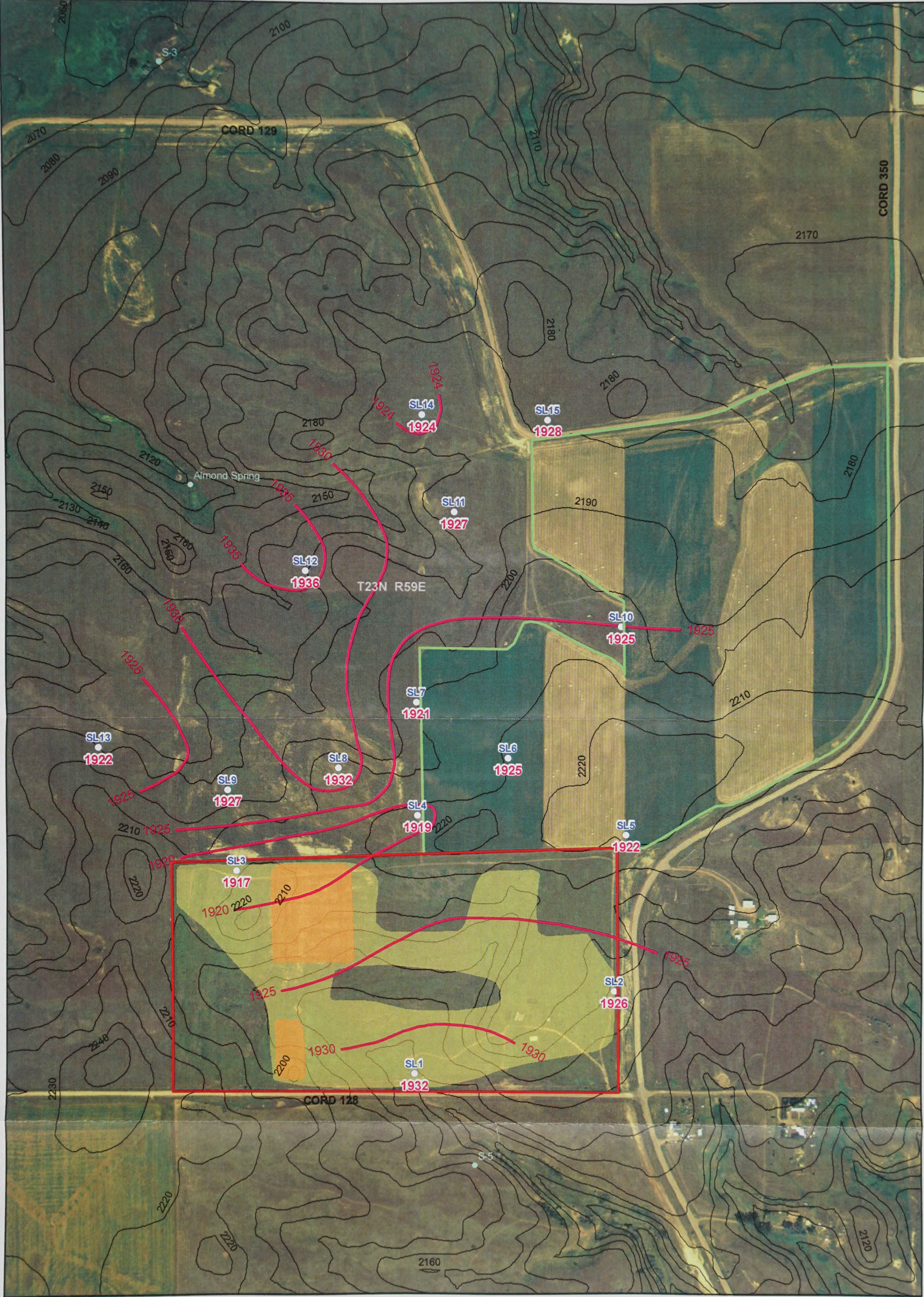


Figure 4

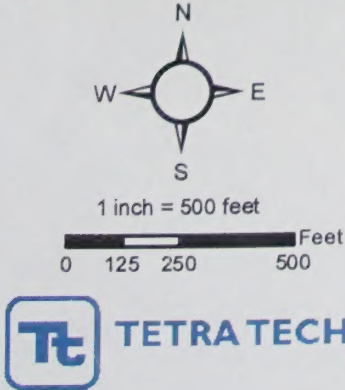


October 2010

**Top of Fort Union Structure
Contour Map**

**Former Richland
County Landfill #102
Sidney, Montana**

Figure 4



Legend

- Landfill Boundary
- Cultivated Field
- Spring

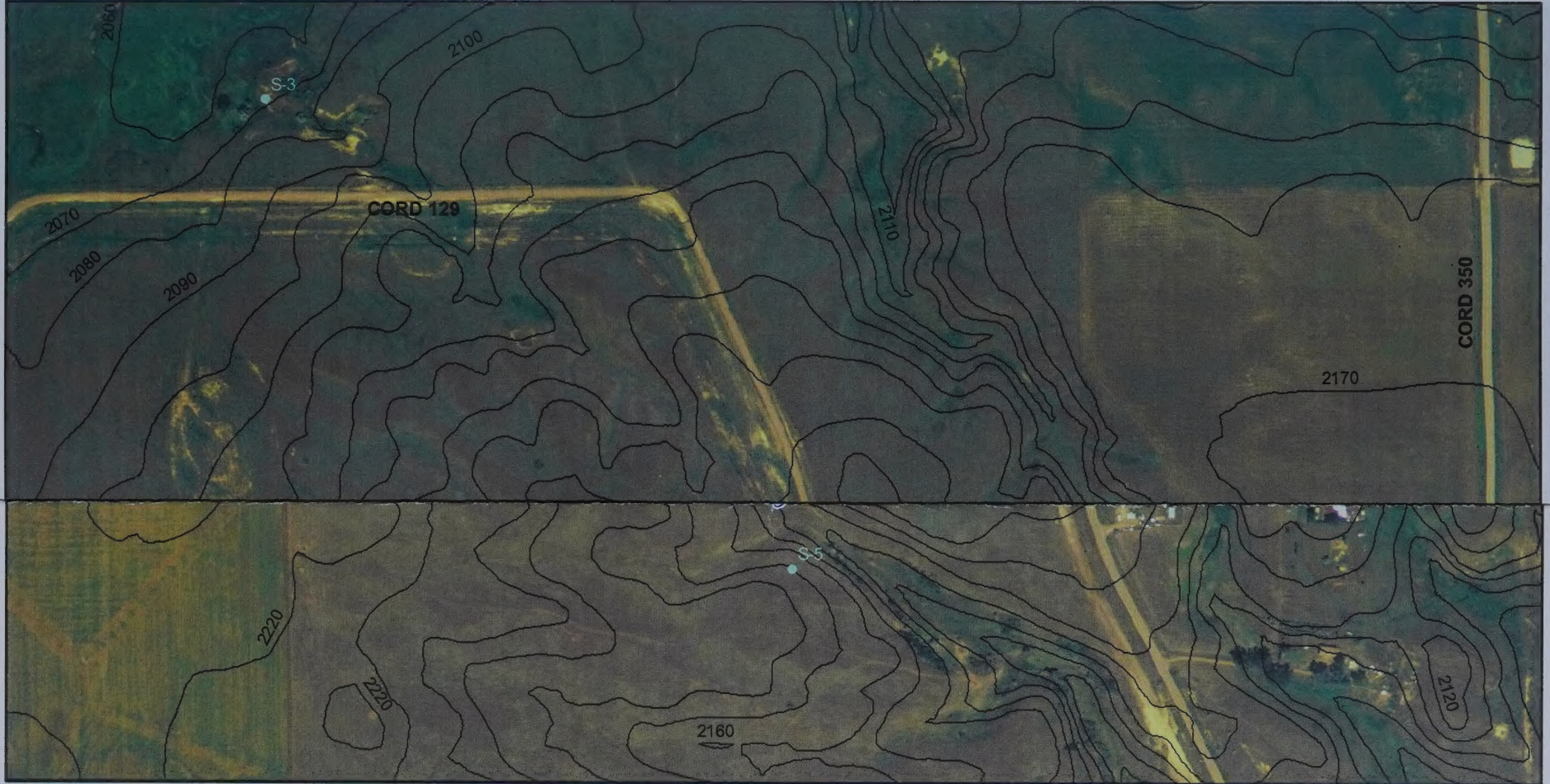
- Waste Area Deep
- Waste Area Shallow
- Elevation Contour
(Feet AMSL: Above Mean
Sea Level)

(Source: USGS 1/3-Arc Second
National Elevation Dataset. Does not
correspond to surveyed well elevations.)

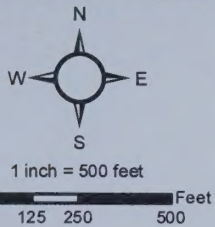
- SL1 Drill Hole/Monitoring Well

- 1932 Intersection of Fort
Union Formation
(Feet AMSL: Above Mean Sea Level)

- 1925 Elevation of Intersection of Fort
Union Formation Contour
(Feet AMSL: Above Mean Sea Level)



October 2010



Legend

- Landfill Boundary
- Cultivated Field
- Spring

- Waste Area Deep
- Waste Area Shallow
- Elevation Contour
(Feet AMSL: Above Mean Sea Level)

(Source: USGS 1/3-Arc Second
National Elevation Dataset. Does not
correspond to surveyed well elevations.)

SL8

1935.54

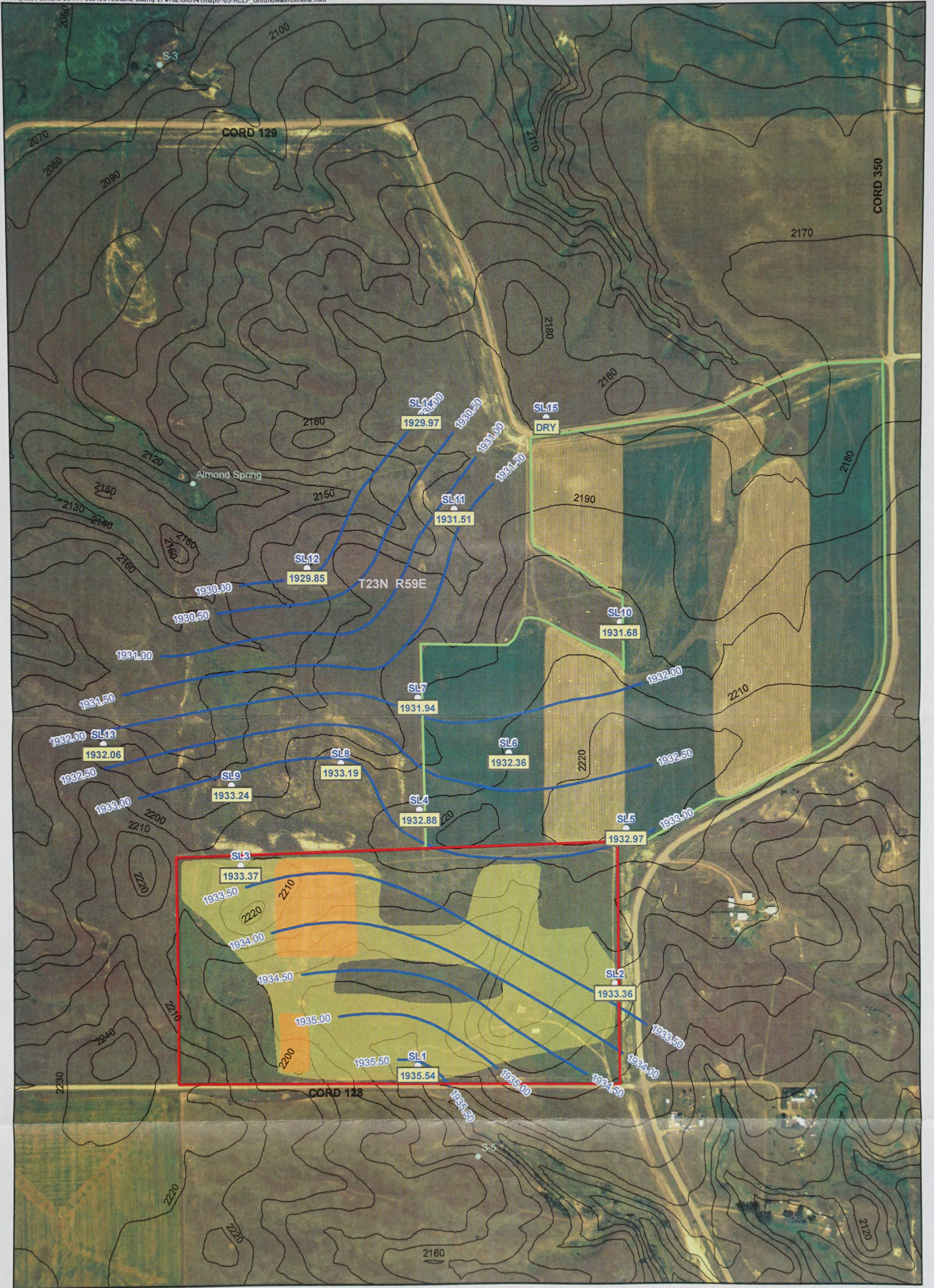
- Groundwater Monitoring Well
(August 20, 2010 - Groundwater
elevation in Feet AMSL: Above Mean Sea Level)
- Groundwater Elevation Contour
(Feet AMSL: Above Mean Sea Level)

**Groundwater Contour Map
August 20, 2010**

**Former Richland
County Landfill #102
Sidney, Montana**



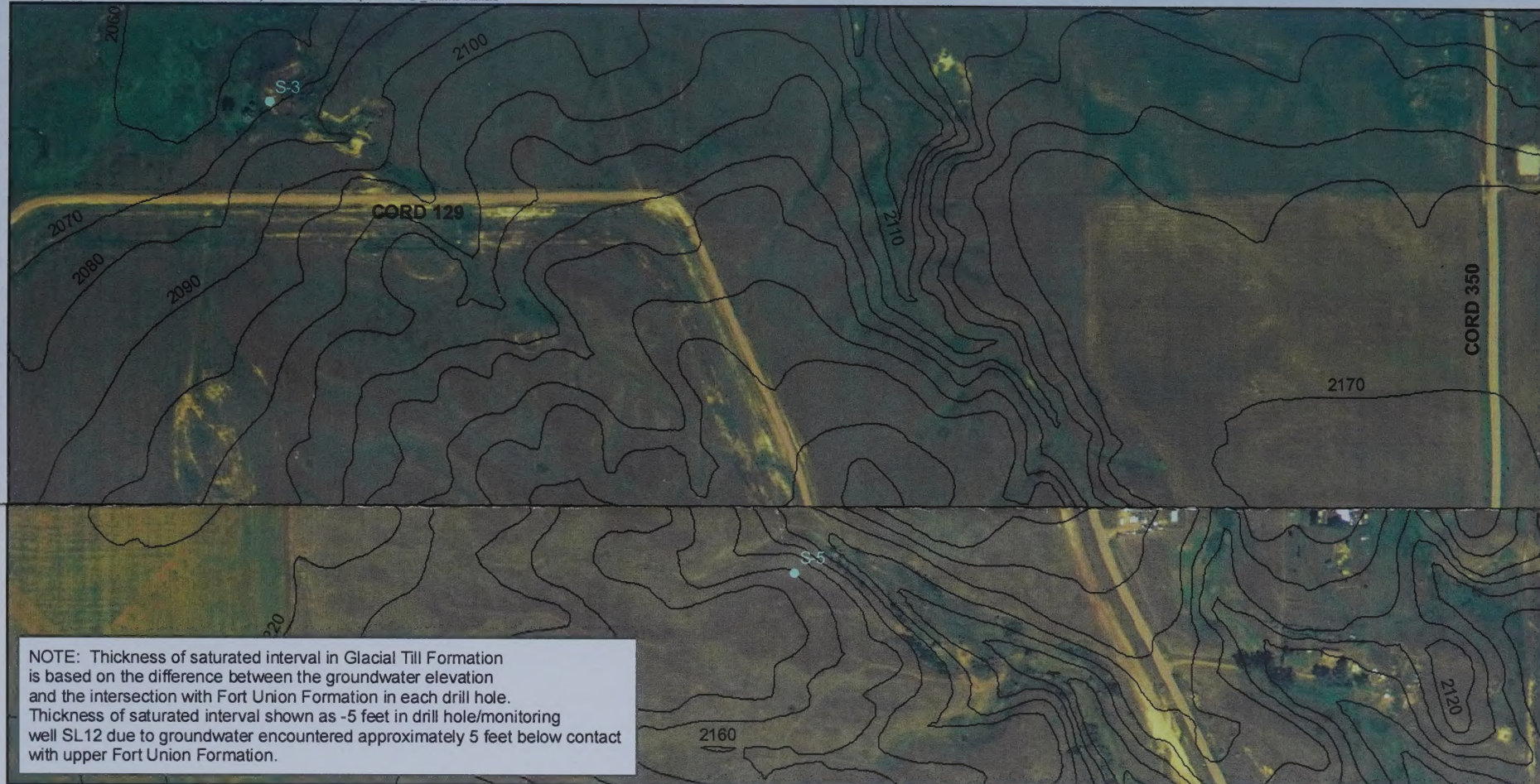
Figure 5



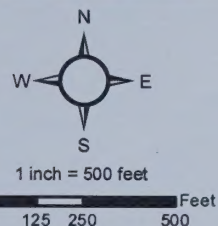
Groundwater Contour Map
August 20, 2010

Former Richland
County Landfill #102
Sidney, Montana

Figure 5



NOTE: Thickness of saturated interval in Glacial Till Formation is based on the difference between the groundwater elevation and the intersection with Fort Union Formation in each drill hole. Thickness of saturated interval shown as -5 feet in drill hole/monitoring well SL12 due to groundwater encountered approximately 5 feet below contact with upper Fort Union Formation.



Legend

- Landfill Boundary
- Cultivated Field
- Spring

- Waste Area Deep
- Waste Area Shallow
- Elevation Contour
(Feet AMSL: Above Mean Sea Level)

(Source: USGS 1/3-Arc Second National Elevation Dataset. Does not correspond to surveyed well elevations.)

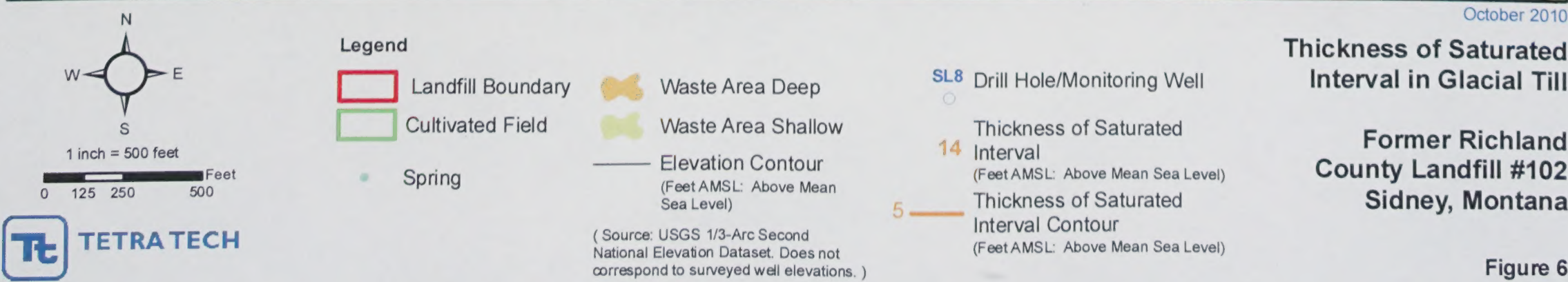
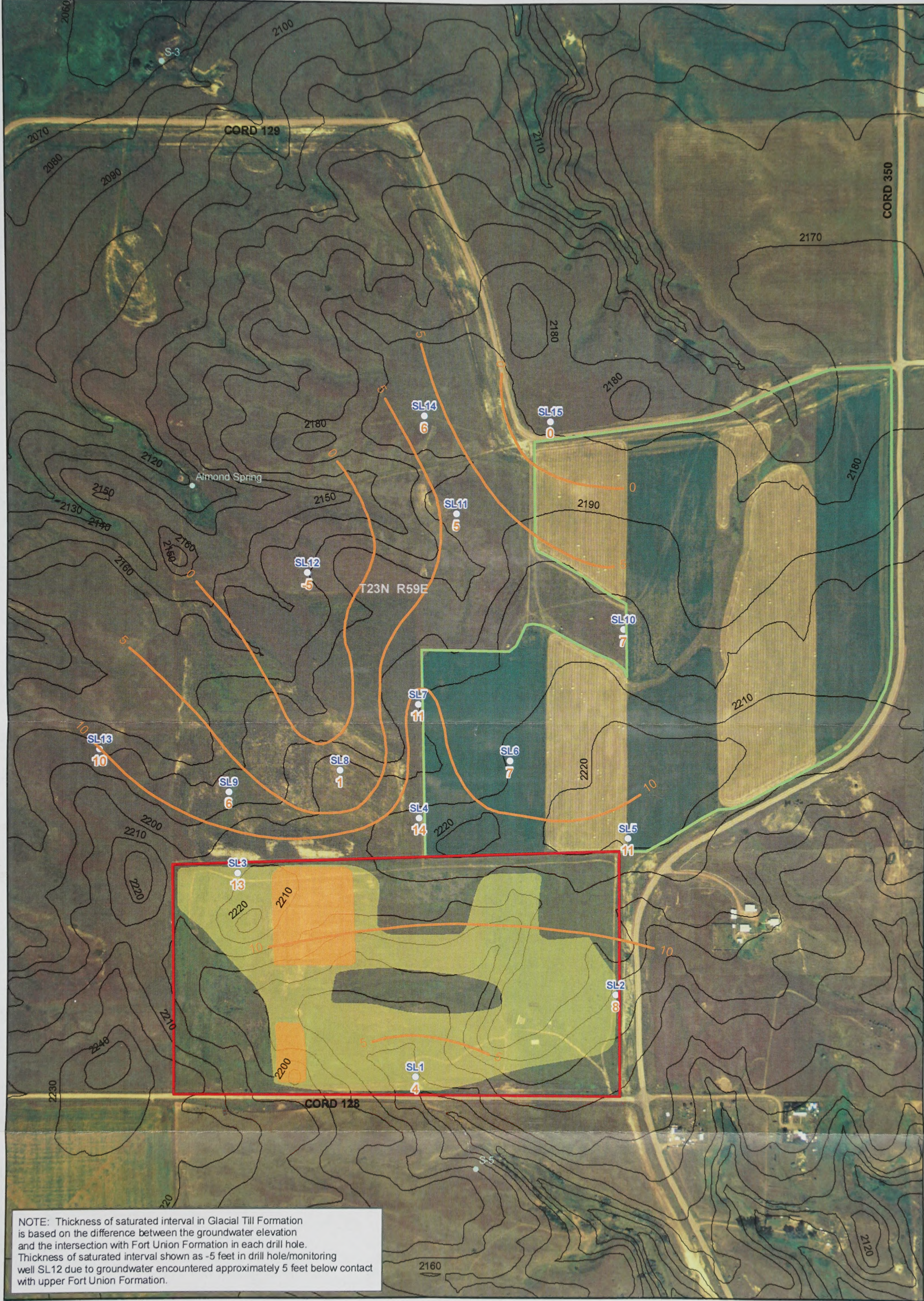
- SL8 Drill Hole/Monitoring Well
- Thickness of Saturated Interval
(Feet AMSL: Above Mean Sea Level)
- 14 Thickness of Saturated Interval Contour
(Feet AMSL: Above Mean Sea Level)
- 5 Thickness of Saturated Interval Contour
(Feet AMSL: Above Mean Sea Level)

October 2010

Thickness of Saturated Interval in Glacial Till

**Former Richland County Landfill #102
Sidney, Montana**

Figure 6

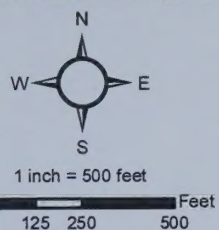




October 2010

Tetrachloroethene in Monitoring Wells - July 2010

**Former Richland
County Landfill #102
Sidney, Montana**



Legend

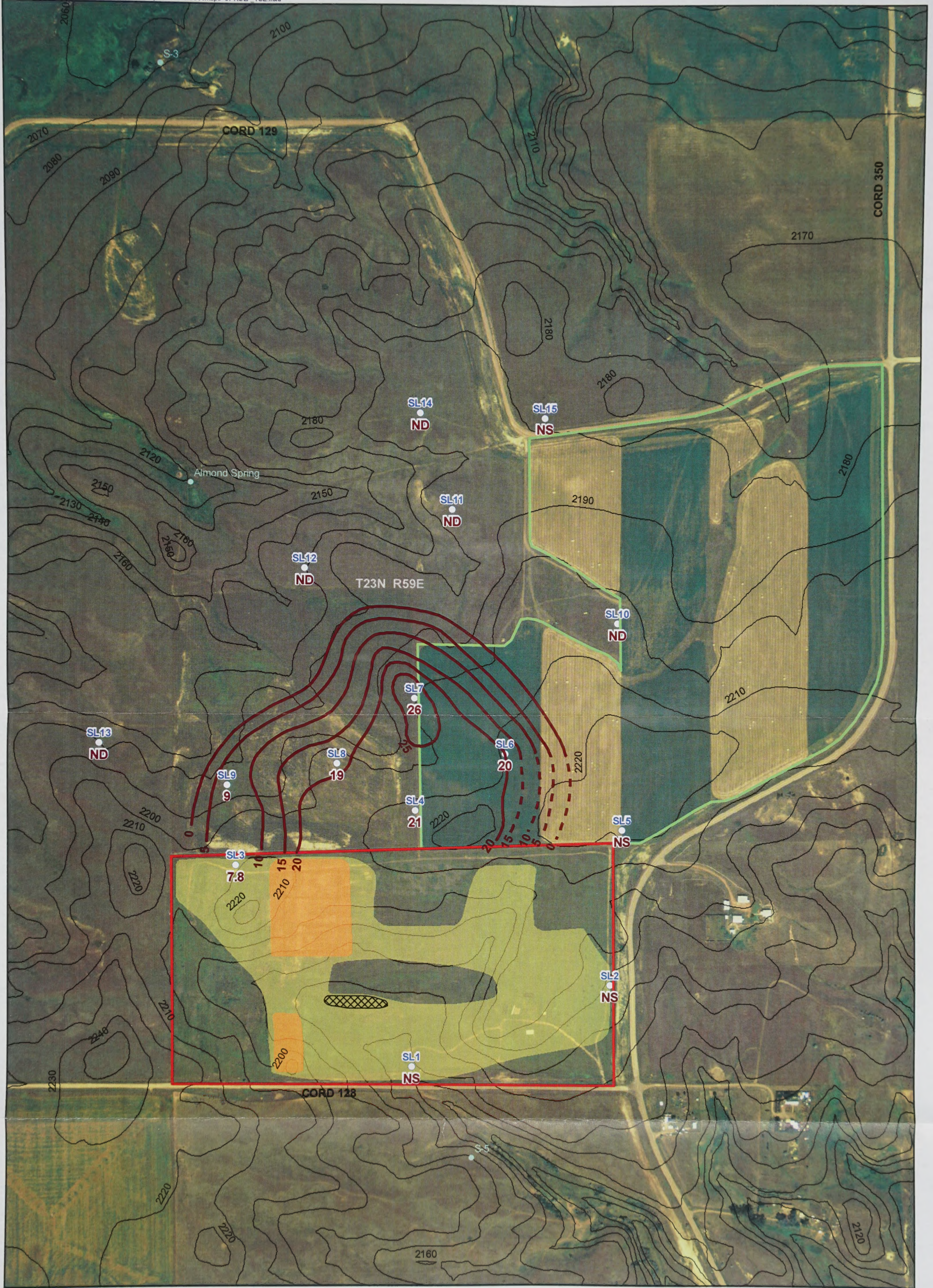
- Landfill Boundary
- Cultivated Field
- Spring

- Waste Area Deep
- Waste Area Shallow
- Elevation Contour
(Feet AMSL: Above Mean Sea Level)

(Source: USGS 1/3-Arc Second National Elevation Dataset. Does not correspond to surveyed well elevations.)

- SL8 Monitoring Well
Sampled July 24-30, 2010
(concentration of tetrachloroethene, micrograms per liter)
- 14
- ND Not Detected above analyte reporting limit
- NS Not Sampled
- 10 — Tetrachloroethene Concentration Contour
(micrograms per liter) Dashed where inferred

Figure 7



October 2010

Tetrachloroethene in Monitoring Wells - July 2010

Former Richland County Landfill #102
Sidney, Montana

Legend

- Landfill Boundary
- Cultivated Field
- Spring

- Waste Area Deep
- Waste Area Shallow
- Elevation Contour
(Feet AMSL: Above Mean Sea Level)

(Source: USGS 1/3-Arc Second National Elevation Dataset. Does not correspond to surveyed well elevations.)

- SL8 Monitoring Well
Sampled July 24-30, 2010
(concentration of tetrachloroethene, micrograms per liter)
- 14
- ND Not Detected above analyte reporting limit
- NS Not Sampled

Tetrachloroethene Concentration Contour
(micrograms per liter) Dashed where inferred

TABLE 1

SUMMARY OF MONITORING WELL SPECIFICATIONS AND LITHOLOGY
 FARMER, HILLMAN AND COUNTY LANDFILL #102
 BOWEN, MONTANA

Well ID	Well Name	Well Type	Well Depth (ft)	Well Diameter (in)	Well Construction	Well Completion	Well Elevation (ft)	Well Status	Well Location	Well Notes
101	101	Monitoring	100	6	Steel	Gravel	100	Active	101	101
102	102	Monitoring	100	6	Steel	Gravel	100	Active	102	102
103	103	Monitoring	100	6	Steel	Gravel	100	Active	103	103
104	104	Monitoring	100	6	Steel	Gravel	100	Active	104	104
105	105	Monitoring	100	6	Steel	Gravel	100	Active	105	105
106	106	Monitoring	100	6	Steel	Gravel	100	Active	106	106
107	107	Monitoring	100	6	Steel	Gravel	100	Active	107	107
108	108	Monitoring	100	6	Steel	Gravel	100	Active	108	108
109	109	Monitoring	100	6	Steel	Gravel	100	Active	109	109
110	110	Monitoring	100	6	Steel	Gravel	100	Active	110	110
111	111	Monitoring	100	6	Steel	Gravel	100	Active	111	111
112	112	Monitoring	100	6	Steel	Gravel	100	Active	112	112
113	113	Monitoring	100	6	Steel	Gravel	100	Active	113	113
114	114	Monitoring	100	6	Steel	Gravel	100	Active	114	114
115	115	Monitoring	100	6	Steel	Gravel	100	Active	115	115
116	116	Monitoring	100	6	Steel	Gravel	100	Active	116	116
117	117	Monitoring	100	6	Steel	Gravel	100	Active	117	117
118	118	Monitoring	100	6	Steel	Gravel	100	Active	118	118
119	119	Monitoring	100	6	Steel	Gravel	100	Active	119	119
120	120	Monitoring	100	6	Steel	Gravel	100	Active	120	120

APPENDIX B

TABLES

TABLE 1 Summary of Monitoring Well Specifications and Lithology

TABLE 2 Field Parameter Measurements – July 2010

TABLE 3 Summary of Selected Chlorinated Solvent Compound Concentrations

TABLE 2
FIELD PARAMETER MEASUREMENTS - JULY 2010
FORMER RICHLAND COUNTY LANDFILL #102
SIDNEY, MONTANA

MONITORING WELL	DATE	TEMPERATURE (deg C)	pH	SPECIFIC CONDUCTIVITY (uS/cm)	DISSOLVED OXYGEN (mg/L)
SL-1	7/24/2010	Not Measured			
SL-2	7/24/2010	Not Measured			
SL-3	7/25/2010	10.9	6.77	2308	0.19
SL-4	7/25/2010	9.5	7.09	2168	4.02
SL-5	7/25/2010				
SL-6	7/25/2010	9.3	7.25	1414	0.87
SL-7	7/24/2010	9.3	6.9	1484	0.93
SL-8	7/24/2010	10.1	6.81	2339	3.33
SL-9	7/24/2010	9.6	6.8	2047	0.42
SL-10	7/27/2010	10.6	7.59	865	9.12
SL-11	7/27/2010	10.8	7.59	1127	5.52
SL-12	7/28/2010	10	7.61	1441	0.10
SL-13	7/28/2010	10.7	7.62	651	0.83
SL-14	7/30/2010	10.1	7.62	809	5.63
SL-15	7/30/2010	Dry			

TABLE 3
SUMMARY OF SELECTED CHLORINATED SOLVENT COMPOUND CONCENTRATIONS
FORMER RICHLAND COUNTY LANDFILL #102
SIDNEY, MONTANA

Well	Date	Chloroform (TCM)	1,1 Dichloroethane (11DCA)	c1,2 Dichloroethene (c12DCE)	Tetrachloroethene (PCE)	1,1,1 Trichloro -ethane (111TCA)	Trichloroethene (TCE)	Dichlorodifluoro -methane (Freon 11)	Total Chlorinated Solvents
Human Health Std		70 HA	--	4	5	200	5	1,000	--
SL-1	7/24/2010	NS	NS	NS	NS	NS	NS	NS	--
SL-2	7/24/2010	NS	NS	NS	NS	NS	NS	NS	--
SL-3	7/25/2010	1.1	3.5	2.9	7.8	ND	1.2	3.6	20.1
SL-4	7/25/2010	0.7	0.22	0.32	21	0.25	0.51	0.35	23.4
SL-5	7/24/2010	NS	NS	NS	NS	NS	NS	NS	0.0
SL-6	7/25/2010	0.44	ND	0.38	20	0.28	0.47	0.43	22.0
SL-7	7/24/2010	0.37	0.65	0.28	26	2.8	0.69	0.43	31.2
SL-8	7/24/2010	0.78	2.1	0.87	19	1.9	0.76	0.33	25.7
SL-9	7/24/2010	1	4	2.1	9	1.4	0.9	1.7	20.1
SL-10	7/27/2010	ND	ND	ND	ND	ND	ND	ND	0.0
SL-11	7/27/2010	ND	ND	ND	ND	ND	ND	ND	0.0
SL-12	7/28/2010	ND	ND	ND	ND	ND	ND	ND	0.0
SL-13	7/28/2010	ND	ND	ND	ND	ND	ND	ND	0.0
SL-14	7/30/2010	ND	ND	ND	ND	ND	ND	ND	0.0
SL-15	7/30/2010	NS	NS	NS	NS	NS	NS	NS	--
Other volatile organic compound concentrations									
Well	Date	Benzene	Toluene	Total Xylenes	Notes: Abbreviation of parameter name shown in parenthesis Concentrations in micrograms per liter Human Health Standard is also Groundwater Protection Standard HA : Health Advisory Exceedance to standard is shaded NS : Not sampled ND : Not detected at or above analytical reporting limit -- : Not applicable				
Human Health Std		5	1,000	10,000					
SL-1	7/24/2010	NS	NS	NS					
SL-2	7/24/2010	NS	NS	NS					
SL-3	7/25/2010	0.54	ND	ND					
SL-4	7/25/2010	ND	ND	ND					
SL-5	7/24/2010	ND	ND	ND					
SL-6	7/25/2010	3.1	0.34	ND					
SL-7	7/24/2010	ND	ND	ND					
SL-8	7/24/2010	0.39	ND	ND					
SL-9	7/24/2010	ND	ND	ND					
SL-10	7/27/2010	ND	ND	ND					
SL-11	7/27/2010	ND	ND	ND					
SL-12	7/28/2010	0.14	0.23	0.2					
SL-13	7/28/2010	ND	ND	ND					
SL-14	7/30/2010	ND	ND	ND					
SL-15	7/30/2010	NS	NS	NS					

NO. 101 111-560133
 NAME Lindell #102-
 Location Richland Co.
 DATE 1/11/57
 TIME 10:00 AM
 BY Geo. F. Barrett

SECTION NO. 10
 SHEET 1 OF 2
 LOCATION Richland Co.

DATE OF 1956.15
 BY 1/12/10
 THE STATE 1/12/10
 THE STATE 1/12/10

DEPTH (ft)	DIP	LITHOLOGY AND DESCRIPTION	CORRECTION (ft)	TESTING RESULTS				
				WATER	WATER	WATER	WATER	WATER
0		Topsoil						
10		Topsoil (5 ft) fine gr. sand						
20		Topsoil (5 ft) or clay, color change to light tan below, in spots						
30		Topsoil (5 ft) - 1" thick, could be removed						
40		Topsoil (5 ft) of carbonaceous material						
50		Topsoil (5 ft) of clay (sand, brown)						

APPENDIX C

Drilling Logs

on back of this sheet
 for well completion

10 - 100 ft
 20 - 200 ft
 30 - 300 ft
 40 - 400 ft
 50 - 500 ft
 60 - 600 ft
 70 - 700 ft
 80 - 800 ft
 90 - 900 ft
 100 - 1000 ft

PROJECT: NUMBER: 114-560133
 NAME: Landfill #102
Richland Co.
 DRILL TYPE: SOIL: ✓
 ROCK: ✓
 DRILLED BY: HazTech HSA Bk-81
 LOGGED BY: Mark F. Pearson
 REMARKS: _____

MONITORING WELL/BORING NO. SL-10
 SHEET 1 OF 3
 LOCATION: Northeasternmost well
 ELEVATION: TOP OF HOLE: 1996.25
 (ft) GROUNDWATER: -
 DATE: STARTED: 7/26/10 COMPLETED: 7/27/10
 TIME: STARTED: 1450 COMPLETED: 800

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					HNU (PID) HEADSPACE	OVA (FID) HEADSPACE	ODOR	STAINING
0.0		Topsoil						
5.0		Tan sand (SM) Fine gr. sl. moist		8/13/15				
10.0		Tan sand (SM) as above, color change to lighter tan midway in spoon		13/24/39				
15.0		Gravel layer ~ 1" thick, Cont'd Sand as above Tan color (SM)		6/9/10				
20.0		Thin seam .075" of carboniferous material Cont'd Sand (SM)		11/9/12				
25.0		Tan + lt. tan sand (SM) w/ gravel and thin <0.25" clay lenses (scattered, trace occur.)		10/21/30				
30.0				18/24/30				

see back of this sheet for well completion

see back of this sheet for well completion →

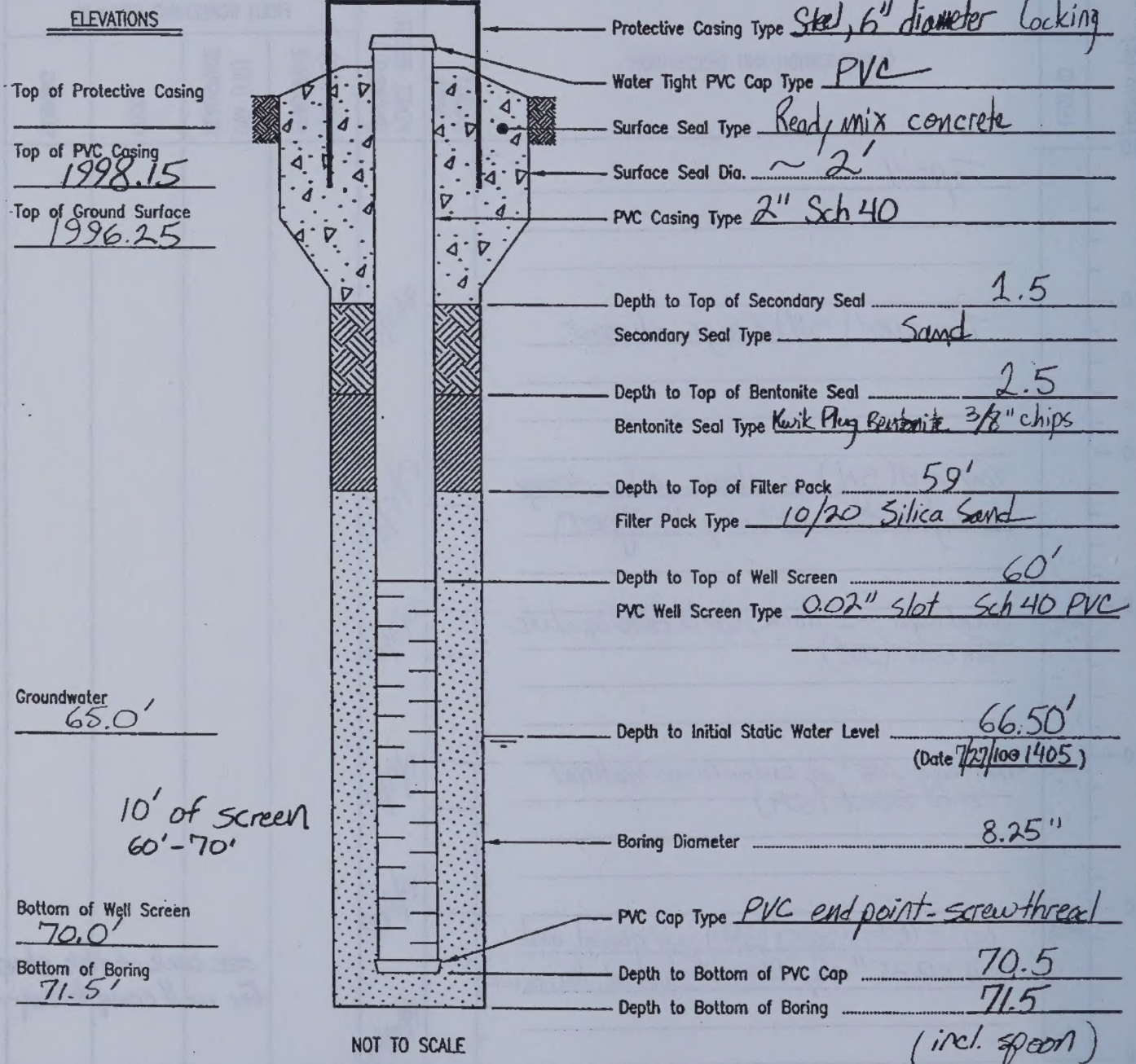
CAL = CALIFORNIA
 SS = SPLIT SPOON
 ST = SHELBY TUBE
 DB = DISTURBED BULK /BAG SAMPLE
 CON = CONTINUOUS SAMPLE
 CORE = CORE SAMPLE
 CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
 -- = NOT ANALYZED
 NS = NO SHEEN
 SS = SLIGHT SHEEN
 MS = MODERATE SHEEN
 HS = HEAVY SHEEN
 -- =

DEPTH TO BOTTOM OF BORING
71.5'

MAXIM
 TECHNOLOGIES, INC.

PROJECT: NUMBER: 114-560133
 NAME: Landfill #102
Richland Co.
 DRILL TYPE: SOIL: ☒
 ROCK: ☒
 DRILLED BY: HazTech
 LOGGED BY: M.F. Pearson
 REMARKS: _____

MONITORING WELL NO. SL-10
 SHEET 1 OF 1
 LOCATION: _____
 DATE: HOLE STARTED: 7/26/10
 COMPLETED: 7/27/10



NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: 114-560133
 NAME: Landfill #102
Richland Co.
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: Longear BK-81 HSA-drill rig

MONITORING WELL/BORING NO. SL-10
 SHEET 2 OF 3
 LOCATION: _____
 ELEVATION: TOP OF HOLE: _____
 (ft) GROUNDWATER: _____
 DATE: STARTED: _____ COMPLETED: _____
 TIME: STARTED: _____ COMPLETED: _____

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					HNU (PID) HEADSPACE	OVA (FID) HEADSPACE	ODOR	STAINING
30.0								
1635		Cont'd Sand (SM) w/ scattered gravel		19/37/138				
time		or lenses of gravel (up to ~1")						
		moist						
35.0		Carboniferous clay lense < 1" - 35' w/ sl. more moisture		10/20/25				
		Cont'd Sand (SM) w/ scattered gravel						
		as above moist						
40.0		Change to Gravel w/ Fines (GM) at about		12/30/50/5				
1650		39", cont'd moist, olive-gray and gr gray						
		Sand w/ scattered gravel to 45.7'						
45.0		GM lense to ~45.5', Cont'd moist, not wet		8/23/136				
520.0		Cont'd sand and gravel ~3" gravel w/ silty clay lense at 51' w/ high moisture. otherwise, sample is moist. Light gray to light brown		25/27/28				
575.0		Cont'd sand and gravel w/ lense ~1" of gravel in silty clay matrix. Yel-orange oxidation on gravel/clay		18/27/39				
		Cont'd moist						
30.0								

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 CHEMICAL ANALYSIS
 - - = NOT ANALYZED

HS = NO SHEEN
 SS = SLIGHT SHEEN
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 HS = HEAVY SHEEN
 - - =

DEPTH TO BOTTOM OF BORING
71.5'

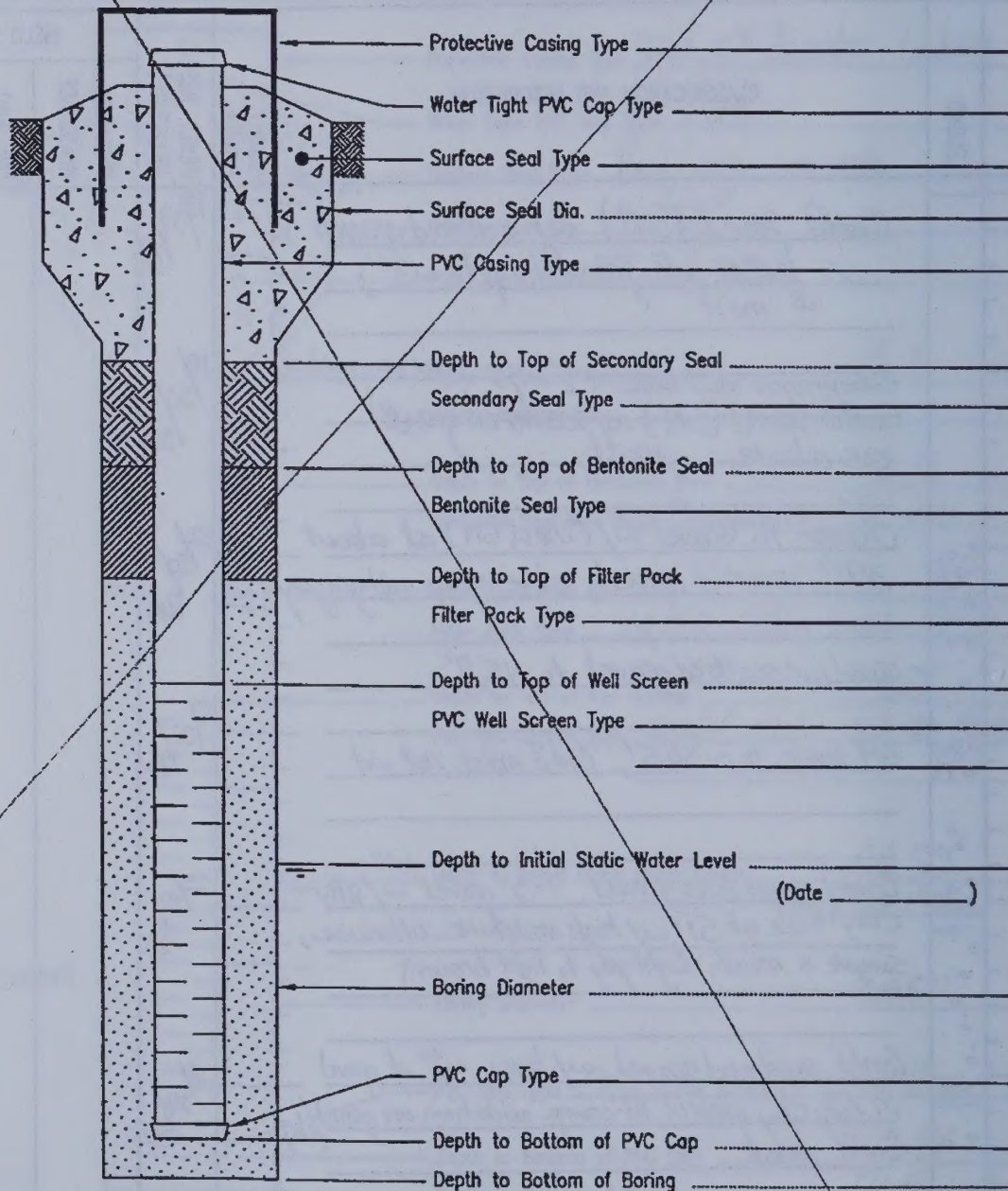
MAXIM
 TECHNOLOGIES, INC.

PROJECT: NUMBER: _____
 NAME: _____
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL NO. _____
 SHEET 1 OF 1
 LOCATION: _____
 DATE: HOLE STARTED: _____
 COMPLETED: _____

ELEVATIONS

Top of Protective Casing _____
 Top of PVC Casing _____
 Top of Ground Surface _____



Groundwater

Bottom of Well Screen

Bottom of Boring

NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

MAXIM
 TECHNOLOGIES, INC.

PROJECT: NUMBER: 114-560133
 NAME: Landfill #102
Richland Co.
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL/BORING NO. SL-10
 SHEET 3 OF 3
 LOCATION: _____
 ELEVATION: TOP OF HOLE: _____
 (ft) GROUNDWATER: _____
 DATE: STARTED: _____ COMPLETED: _____
 TIME: STARTED: _____ COMPLETED: _____

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					HNU (PID) HEADSPACE	OVA (FID) HEADSPACE	ODOR	STAINING
60.0								
1745		Cont'd Sand and Gravel (GM) moist		17/25/23				
		7/27/10 7AM Drill Bit in water @ 65' depth - black fine material in water - carbon						
65.0		Spoon in water Sand/Gravel decr. Fines GM/GP		6/14/17	65'			Carbon
		Carboniferous GM/GP 65-66'						
		Decr. Gravel at 68'						
70.0		Gray Shale sl. moist @ 70.1' depth		7/17/43				
		light gray TD - 71.5'						
75.0								
80.0								
85.0								
30.0								

CAL = CALIFORNIA
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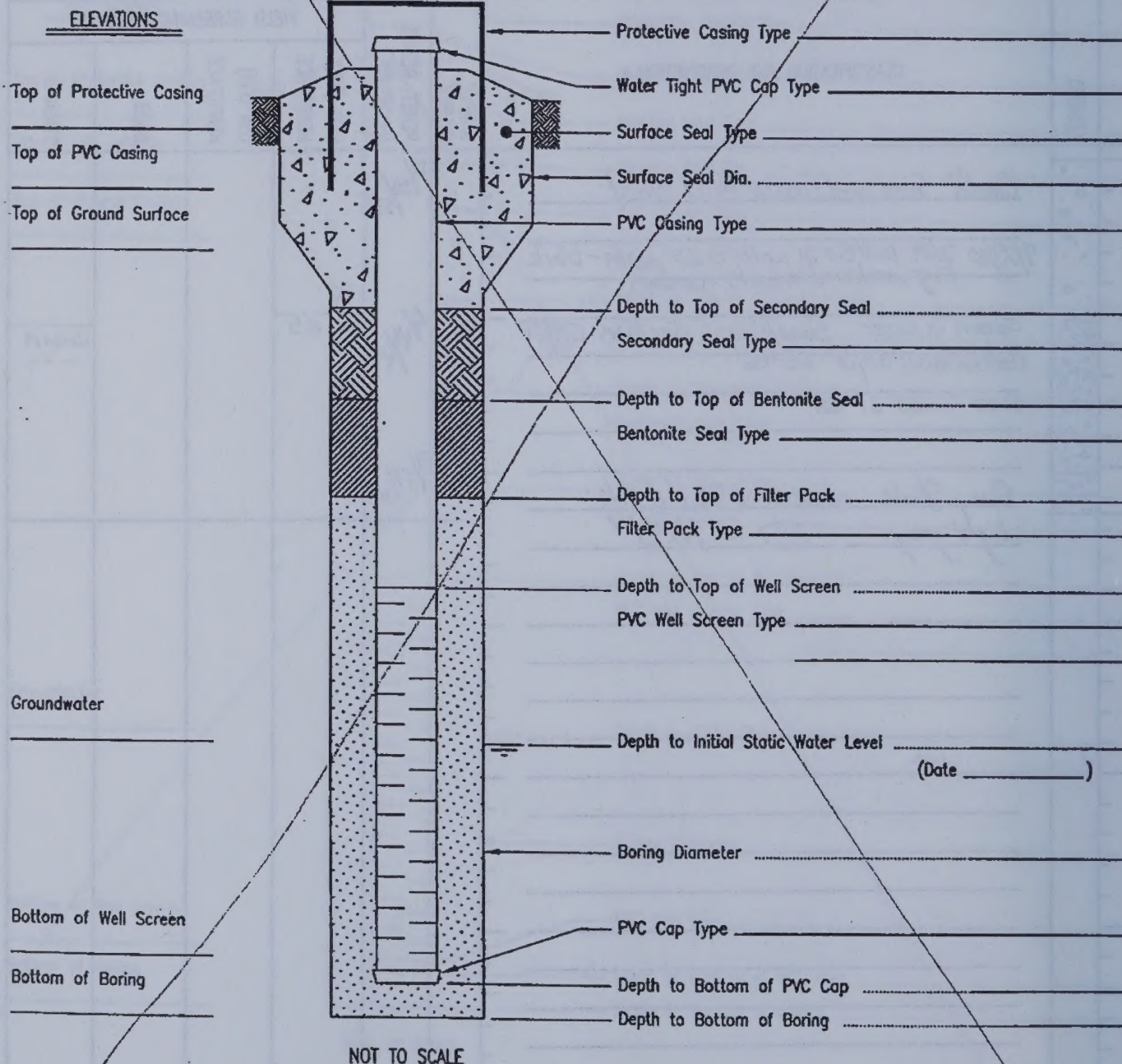
DEPTH TO BOTTOM OF BORING

71.5'

MAXIM
 TECHNOLOGIES, INC.

PROJECT: NUMBER: _____
 NAME: _____
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL NO. _____
 SHEET 1 OF 1
 LOCATION: _____
 DATE: HOLE STARTED: _____
 COMPLETED: _____



NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: 114-560133
NAME: Landfill #102
Richland Co.
DRILL TYPE: SOIL: ✓
ROCK: ✓
DRILLED BY: HazTech HSA BK-81
LOGGED BY: Mark F. Pearson
REMARKS: _____

MONITORING WELL/BORING NO. SL-11
SHEET 1 OF 2
LOCATION: _____
ELEVATION: TOP OF HOLE: 1978.05
(ft) GROUNDWATER: _____
DATE: STARTED: 7/27/10 COMPLETED: 7/27/10
TIME: STARTED: 1045 COMPLETED: 1536

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					HNU (PID) HEADSPACE	OVA (FID) HEADSPACE	ODOR	STAINING
0.0		~ 4" topsoil						
10.50		Sand, light brown, SM, moist						
5.0		Well sorted, fn. grained sand (SW) H. brn, moist		5/4/6				
10.0		Cont'd well sorted, fn. gr. sand w/ ~ 1/8" thick silty clay stringers or partings trace gravel		4/6/9				
15.0		Cont'd well sorted as above. w/p clay stringers very moist to wet last one foot of spoon, scattered gravel ~ 2%		8/9/8				
20.0		very moist to wet Change to H. brown sandy silt grading down to clayey silt in spoon		4/6/7				
25.0	?	Sand, fn. gr., H. tan gray, SM		9/11/12				
30.0								

CAL = CALIFORNIA
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ST = SHELBY TUBE
DB = DISTURBED BULK /BAG SAMPLE

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CORE = CORE SAMPLE
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-- = NOT ANALYZED

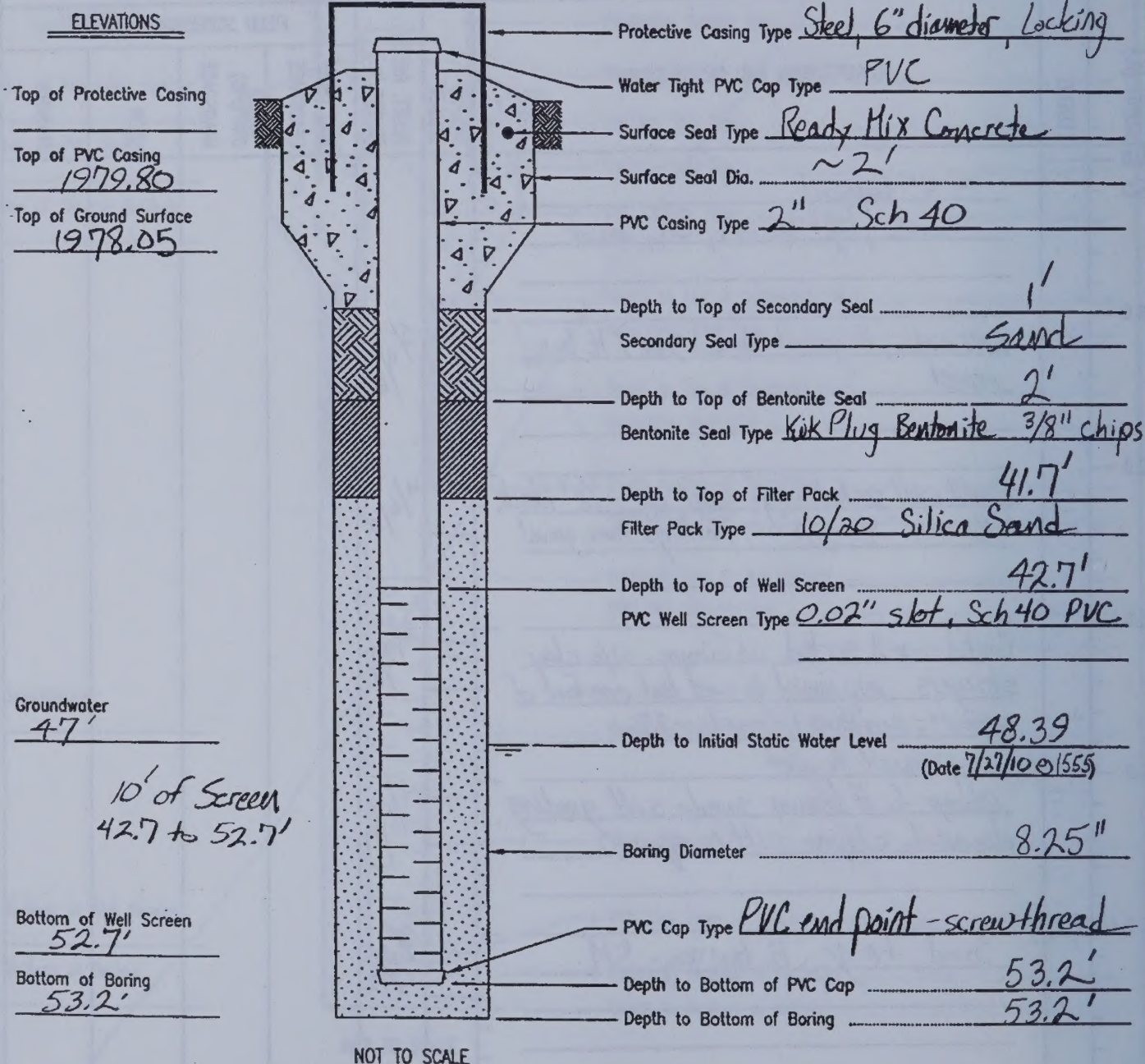
HS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN

DEPTH TO BOTTOM OF BORING
53.2'

MAXIM
TECHNOLOGIES, INC.

PROJECT: NUMBER: 114-560133
NAME: Landfill # 102
Richland Co.
DRILL TYPE: SOIL: ✓
ROCK: ✓
DRILLED BY: HazTech
LOGGED BY: MF Pearson
REMARKS: _____

MONITORING WELL NO. SL-11
SHEET 1 OF 1
LOCATION: _____
DATE: HOLE STARTED: 7/27/10
COMPLETED: 7/27/10



NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: _____
 NAME: _____
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL NO. _____
 SHEET 1 OF 1
 LOCATION: _____
 DATE: HOLE STARTED: _____
 COMPLETED: _____

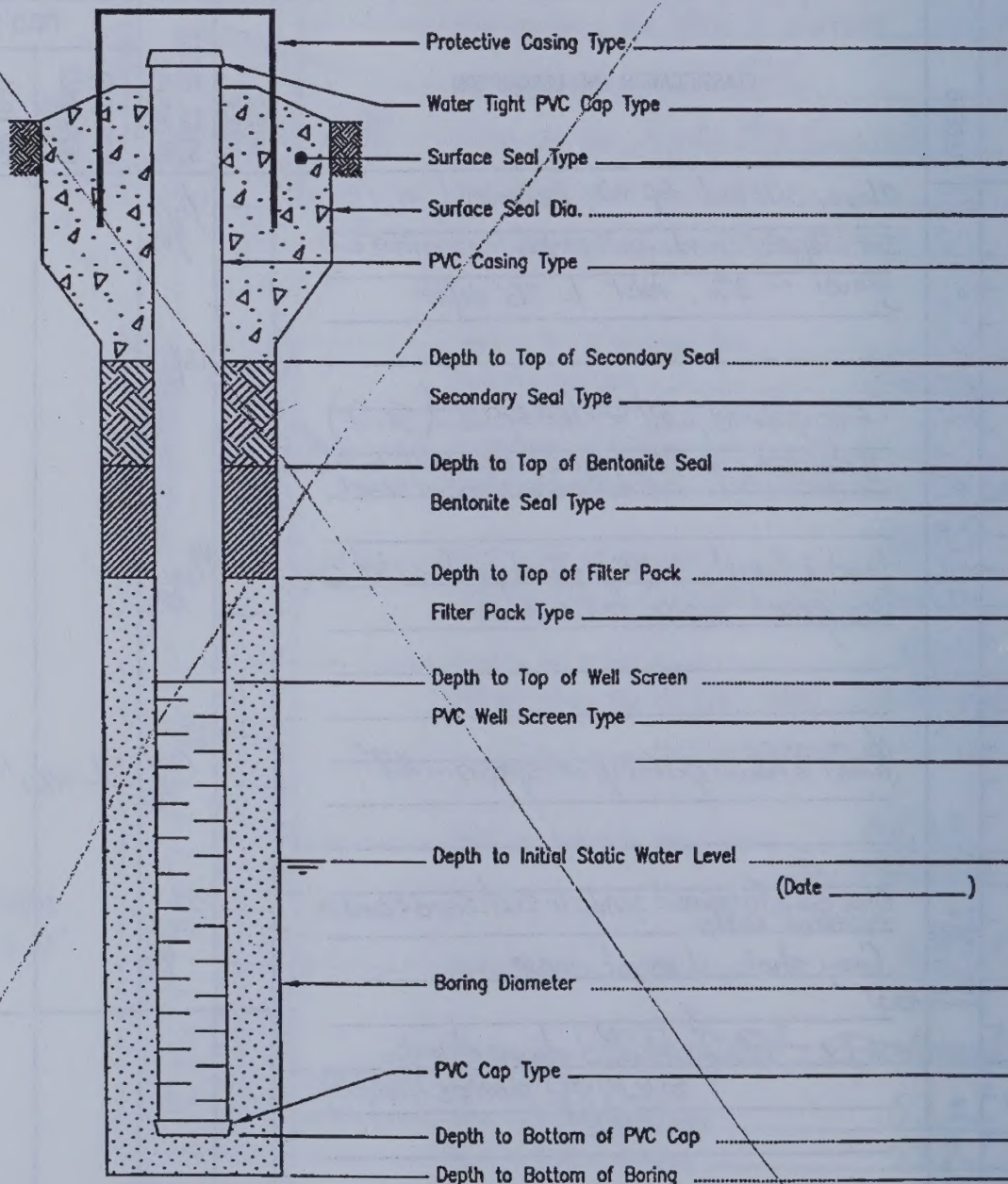
ELEVATIONS

Top of Protective Casing _____
 Top of PVC Casing _____
 Top of Ground Surface _____

Groundwater _____

Bottom of Well Screen _____

Bottom of Boring _____



NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: 114-560133
 NAME: Landfill #102
Richland Co.
 DRILL TYPE: SOIL: ✓
 ROCK: ✓
 DRILLED BY: HazTech HSA BK-81
 LOGGED BY: Mark F. Pearson
 REMARKS: _____

MONITORING WELL/BORING NO. SL-12
 SHEET 1 OF 2
 LOCATION: _____
 ELEVATION: TOP OF HOLE: 1965.70
 (ft) GROUNDWATER: _____
 DATE: STARTED: 7/27/10 COMPLETED: 7/28/10
 TIME: STARTED: 1600 COMPLETED: 1000

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					HNU (PID) HEADSPACE	OVA (FID) HEADSPACE	ODOR	STAINING
0.0		Topsoil						
5.0		clayey silt olive green, dense, silty clay w/ scattered gravel gravel inc. at 6' to 25% (HL)		5/6/10				
10.0		Green-gray sandy silt w/ scattered gravel ~2% fractures w/ white, crystalline mineral (ML) dense		7/13/17				
15.0		Light tan-brown Sand and Gravel (~40% gravel) sl. moist, loose		9/10/8				
20.0		Very moist in Sand & Gravel. Fine Sand at 20.5' (SM) tan gray, dry		11/16/20				
25.0		Sand & Gravel w/ yellow brown oxidation ~30% gravel w/ bigger gravel (GM)		20/35/38				
30.0		Cont'd Sand & Gravel (driller)						

CAL = CALIFORNIA
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 DB = DISTURBED BULK /BAG SAMPLE

CON = CONTINUOUS SAMPLE
 CORE = CORE SAMPLE
 CA = SAMPLE SUBMITTED FOR
 CHEMICAL ANALYSIS
 " " = NOT ANALYZED

NS = NO SHEEN
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 HS = HEAVY SHEEN

DEPTH TO BOTTOM OF BORING

46.5'

MAXIM
 TECHNOLOGIES, INC.

PROJECT: NUMBER: 114-560133
 NAME: Landfill #102
Richland Co.
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: HAZTech
 LOGGED BY: MF Pearson
 REMARKS: _____

MONITORING WELL NO. SL-12
 SHEET 1 OF 1
 LOCATION: _____

DATE: HOLE STARTED: 7/27/10
 COMPLETED: 7/28/10

cell sharp
480-2386

ELEVATIONS

Top of Protective Casing _____
 Top of PVC Casing 1967.75
 Top of Ground Surface 1965.7
 Top of T&U 1935.7
1.75
.3
2.05 stickup

Protective Casing Type Steel, 6" diameter, locking
 Water Tight PVC Cap Type PVC
 Surface Seal Type Ready Mix Concrete
 Surface Seal Dia. ~2'
 PVC Casing Type 2" sch 40
Bottom of concrete - 1.0'
 Depth to Top of Secondary Seal 1'
 Secondary Seal Type Sand
 Depth to Top of Bentonite Seal 2.0'
 Bentonite Seal Type Kwik Plug Bentonite 3/8" chips
 Depth to Top of Filter Pack 24.0
 Filter Pack Type 10/20 Silica Sand
 Depth to Top of Well Screen 25.0'
 PVC Well Screen Type 0.02" slot, sch 40 PVC

Groundwater

Depth to Initial Static Water Level 38.70'
 (Date 7/28/10 @ 1020)
7/28/10 @ 1135 38.37'
 Boring Diameter 8.25'

PVC Cap Type PVC endpoint-screwthread
 Depth to Bottom of PVC Cap 45.5'
 Depth to Bottom of Boring 46.5'

Bottom of Well Screen 45.0
 Bottom of Boring 46.5'

(Including last spoon depth)

NOT TO SCALE

Sand to 46.5'

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

1995.16 B4@SL-13

MAXIM
TECHNOLOGIES, INC.

PROJECT: NUMBER: 114-560133
 NAME: Landfill #102
Richland Co.
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL/BORING NO. SL-12
 SHEET 2 OF 2
 LOCATION: _____
 ELEVATION: TOP OF HOLE: _____
 (ft) GROUNDWATER: _____
 DATE: STARTED: _____ COMPLETED: _____
 TIME: STARTED: _____ COMPLETED: _____

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					HNU (PID) HEADSPACE	OVA (FID) HEADSPACE	ODOR	STAINING
30.0		Lt yellow-brown to grn-brn clay top @ 30'		15/21				
		Oxidation 'Fronts' - yellow brown color grading into a		29				
35.0		Silt/Sandy Silt w/ oxidation in last 1' dense, moist, gray green to 36.3'		12/26				
		Fine, poorly sorted, gray-green sand, moist		41				
40.0		Lt gray, dense, sandy silt/silt, sl. moist		4/28				
7/27/10 1755		trace oxidation 'Fronts' obs. at start of spoon to 45.8'		50/5				
45.0		Gray silt, wet consistently silt, dense		14/27				
7/28/10 810		Obs from 45.8' to 46.5' that silt becomes more dense and is not wet, only moist		40				
50.0		TD 46.5'						
		Fort Union intersected at 30.0'						
25.0								
30.0								

CAL = CALIFORNIA
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 "-" = NOT ANALYZED
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 SS = SLIGHT SHEEN
 MS = MODERATE SHEEN
 HS = HEAVY SHEEN

DEPTH TO BOTTOM OF BORING
46.5' Incl. Spoon

MAXIM
 TECHNOLOGIES, INC.

PROJECT: NUMBER: _____
 NAME: _____
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL NO. _____
 SHEET 1 OF 1
 LOCATION: _____

DATE: HOLE STARTED: _____
 COMPLETED: _____

ELEVATIONS

Top of Protective Casing _____

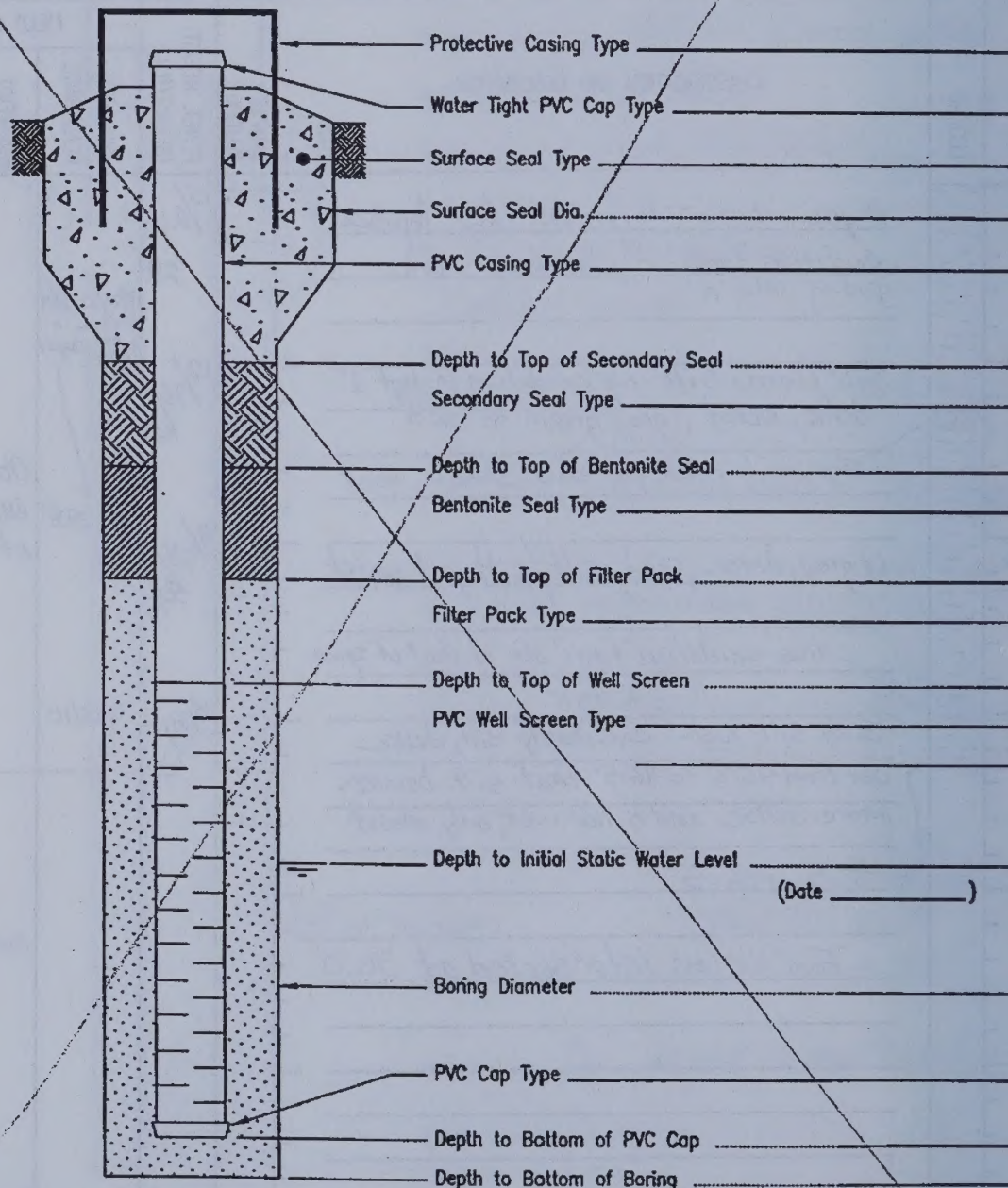
Top of PVC Casing _____

Top of Ground Surface _____

Groundwater _____

Bottom of Well Screen _____

Bottom of Boring _____



NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: 114-560133
 NAME: Landfill #102
Richland Co.
 DRILL TYPE: SOIL: ☒
 ROCK: ☒
 DRILLED BY: HazTech HSA BK-81
 LOGGED BY: Mark F. Pearson
 REMARKS: _____

MONITORING WELL/BORING NO. SL-13
 SHEET 1 OF 3
 LOCATION: Well west of SL-9

ELEVATION: TOP OF HOLE: 1989.67
 (ft) GROUNDWATER: _____
 DATE: STARTED: 7/28/10 COMPLETED: 7/28/10
 TIME: STARTED: 1045 COMPLETED: 1700

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					HNU (PID) HEADSPACE	OVA (FID) HEADSPACE	ODOR	STAINING
0.0		Topsoil						
5.0		Tan sand, well sorted, No. 30 sieve, sl. moist, scattered gravel ~ 1% (SW)		5 1/6 / 8				
10.0				4 1/2 / 7				
15.0		Cont'd tan-brown sand becoming finer grained (No 40 sieve) well sorted, sl. moist		7 1/11 / 11				
20.0		Cont'd tan-brown sand, No 30 to 40 sieve, well sorted, moist		7 1/7 / 7				
25.0		Cont'd sand as above, 0.5% scattered gravel moist		8 1/12 / 14				
30.0		Gravel & Sand loose (driller)						

CAL = CALIFORNIA
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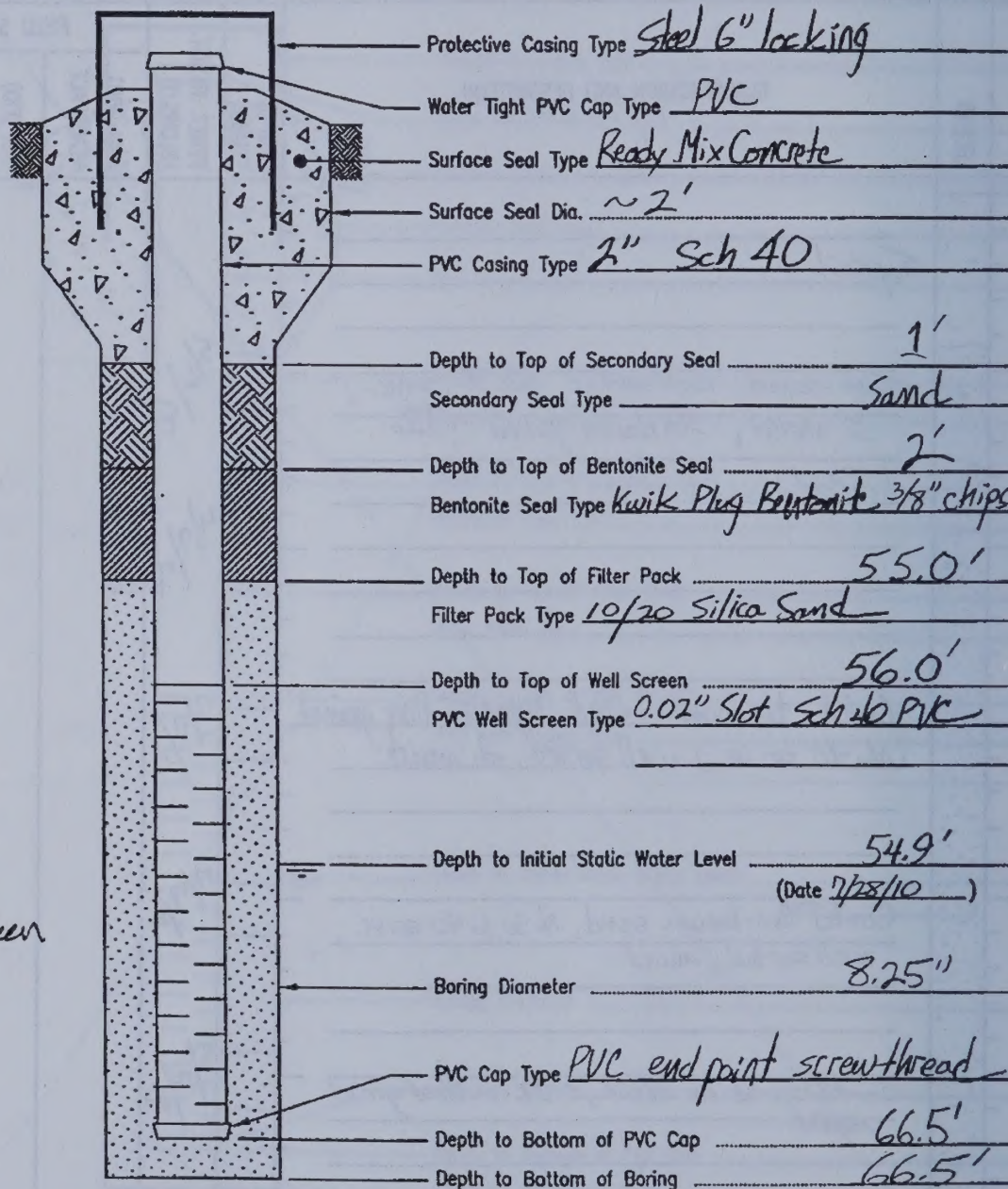
DEPTH TO BOTTOM OF BORING
66.5'

MAXIM
 TECHNOLOGIES, INC.

PROJECT: NUMBER: 114-560133
NAME: Landfill #102
Richland Co.
DRILL TYPE: SOIL: _____
ROCK: _____
DRILLED BY: Hartoch
LOGGED BY: MF Pearson
REMARKS: _____

MONITORING WELL NO. SL-13
SHEET 1 OF 1
LOCATION: _____
DATE: HOLE STARTED: 7/28/10
COMPLETED: 7/28/10

ELEVATIONS
Top of Protective Casing 1989.95'
Top of PVC Casing 1989.71'
Top of Ground Surface 1987.67'



Groundwater
54.9

10' of screen
56' - 66'

Bottom of Well Screen
66.0

Bottom of Boring
66.5

NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

MAXIM
TECHNOLOGIES, INC.

PROJECT: NUMBER: 114-560133.200
 NAME: Landfill #102
Richland County
 DRILL TYPE: SOIL: ☒
 ROCK: _____
 DRILLED BY: Paul Bray HazTech
 LOGGED BY: MF Pearson
 REMARKS: _____

MONITORING WELL/BORING NO. JK-13
 SHEET 2 OF 3
 LOCATION: _____
 ELEVATION: TOP OF HOLE: _____
 (ft) GROUNDWATER: _____
 DATE: STARTED: _____ COMPLETED: _____
 TIME: STARTED: _____ COMPLETED: _____

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					HNU (PID) HEADSPACE	OVA (FID) HEADSPACE	ODOR	STAINING
30.0	88%	Gravel & Sand lens Cont'd sand, well sorted, scattered gravel and gravel lenses	spoon	9/23/27				
35.0		Cont'd light gray sand w/scattered gravel (small) ~0.5 to 1%, moist, some silt clasts - trace		8/20/30				
40.0		Gravel & Sand w/ clayey silt lens (0.2') Cont'd sand fine grained, moist, tan-brown w/scattered gravel: 0.5-1%		9/20/38				
45.0		43.5' change to gravel & sand (driller) Very moist gravel and sand to 44' - Brown Below 45' lt. green gray gravel and sand Sand fraction appears poorly sorted, ~40-50% gravel (GP)		31/41/37				
50.0		Gravel and Sand, very moist to ~50.2' lt. tan-brown to tan, 40-50% gravel, sand fraction ranges from well sorted to poorly sorted		21/38/50/15				
55.0		~10% recovery Sand & Gravel (GP), sl. wet, lt. brown, base, fine grained sand - well sorted		26/32/22				
30.0								

water obs on spoon
▽ 54.9' depth

water obs on spoon
 ▽ 54.9' depth

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 - - =

DEPTH TO BOTTOM OF BORING
66.5'

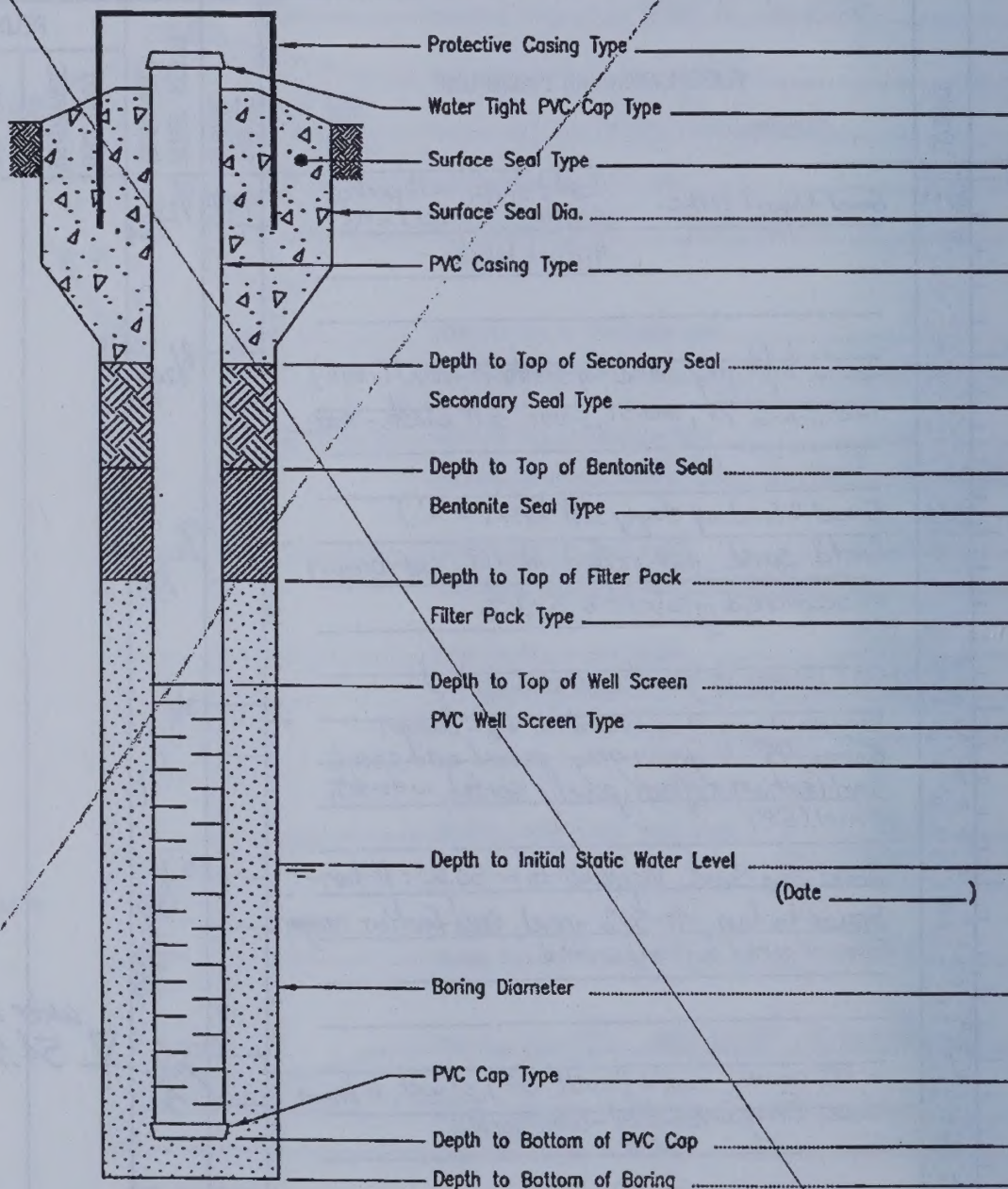
MAXIM
 TECHNOLOGIES, INC.

PROJECT: NUMBER: _____
 NAME: _____
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL NO. _____
 SHEET 1 OF 1
 LOCATION: _____
 DATE: HOLE STARTED: _____
 COMPLETED: _____

ELEVATIONS

Top of Protective Casing _____
 Top of PVC Casing _____
 Top of Ground Surface _____



Groundwater _____
 Bottom of Well Screen _____
 Bottom of Boring _____

NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: 114-560133
NAME: Landfill #102
Richland Co.

MONITORING WELL/BORING NO. SK-13
SHEET 3 OF 3
LOCATION: _____

DRILL TYPE: SOIL: _____
ROCK: _____
DRILLED BY: _____
LOGGED BY: _____
REMARKS: _____

ELEVATION: TOP OF HOLE: _____
(ft) GROUNDWATER: _____
DATE: STARTED: _____ COMPLETED: _____
TIME: STARTED: _____ COMPLETED: _____

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS				
					HNU (PID) HEADSPACE	OVA (FID) HEADSPACE	ODOR	STAINING	
6.00		Gravel & poorly graded sand (GM) - wet, brown, ~50% gravel. No sheen or odor on water in spoon. ← Change in drilling noted - contact?	SP	19/22/23					
6.50		65.8 Contact w/ Fort Union Shale - hard, flinty, green gray w/ pyrite or marcasite TD - 66.5'		15/46/50/5	Time 1400				
10.0		Gravel & Sand w/ carbon, gray to gray black silty to clayey sand matrix, minor oxidation							
15.0									
20.0									
25.0									
30.0									

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ST = SHELBY TUBE
DB = DISTURBED BULK /BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
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DEPTH TO BOTTOM OF BORING
66.5'

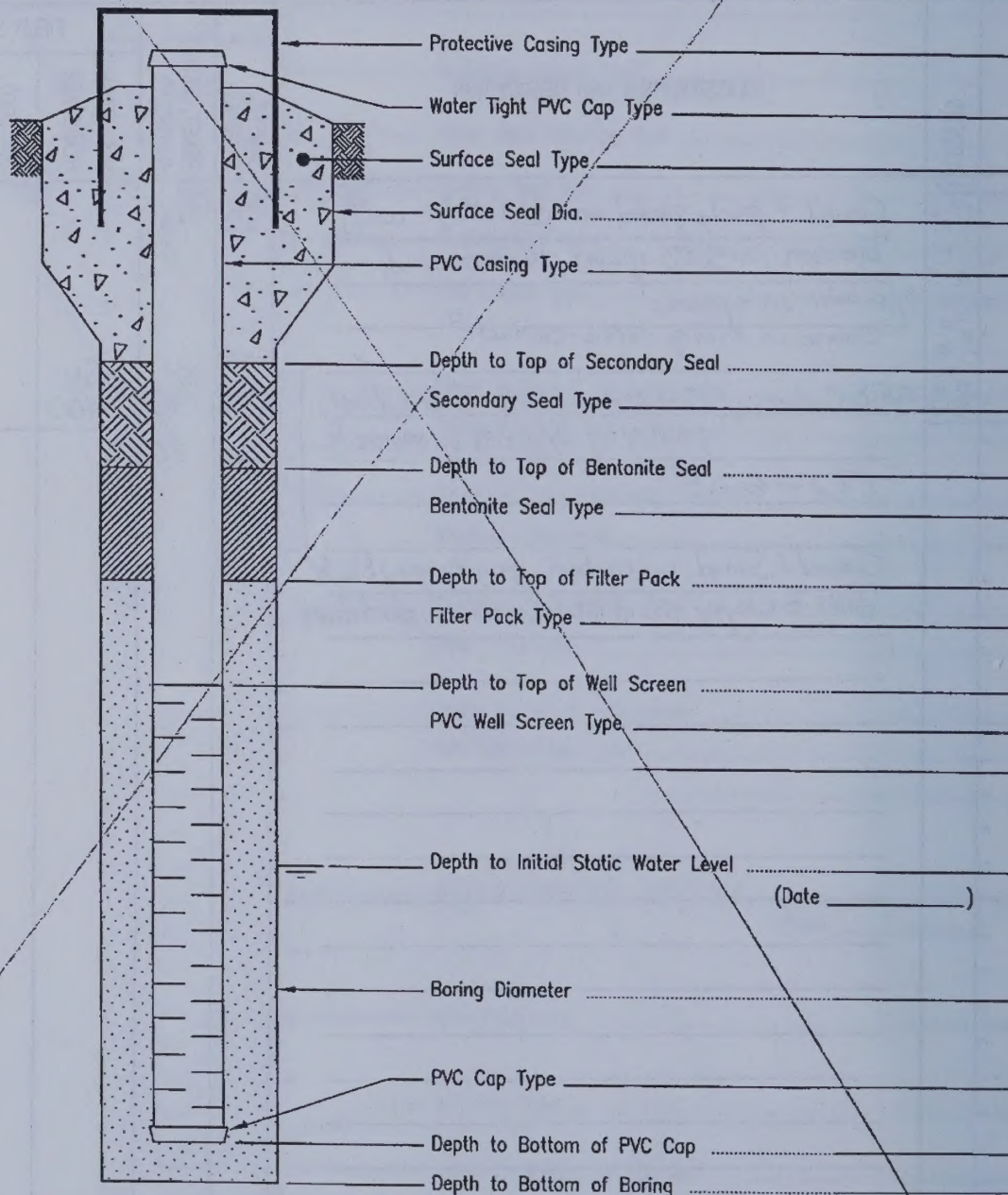
MAXIM
TECHNOLOGIES, INC.

PROJECT: NUMBER: _____
 NAME: _____
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL NO. _____
 SHEET 1 OF 1
 LOCATION: _____
 DATE: HOLE STARTED: _____
 COMPLETED: _____

ELEVATIONS

Top of Protective Casing _____
 Top of PVC Casing _____
 Top of Ground Surface _____



Groundwater _____
 Bottom of Well Screen _____
 Bottom of Boring _____

NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

MONITORING WELL/BORING NO. SL-14
SHEET 1 OF 3
LOCATION: _____

ELEVATION: TOP OF HOLE: 1983.64'
(ft) GROUNDWATER: -
DATE: STARTED: 7/29/10 COMPLETED: 7/29/10
TIME: STARTED: 715 COMPLETED: 1300

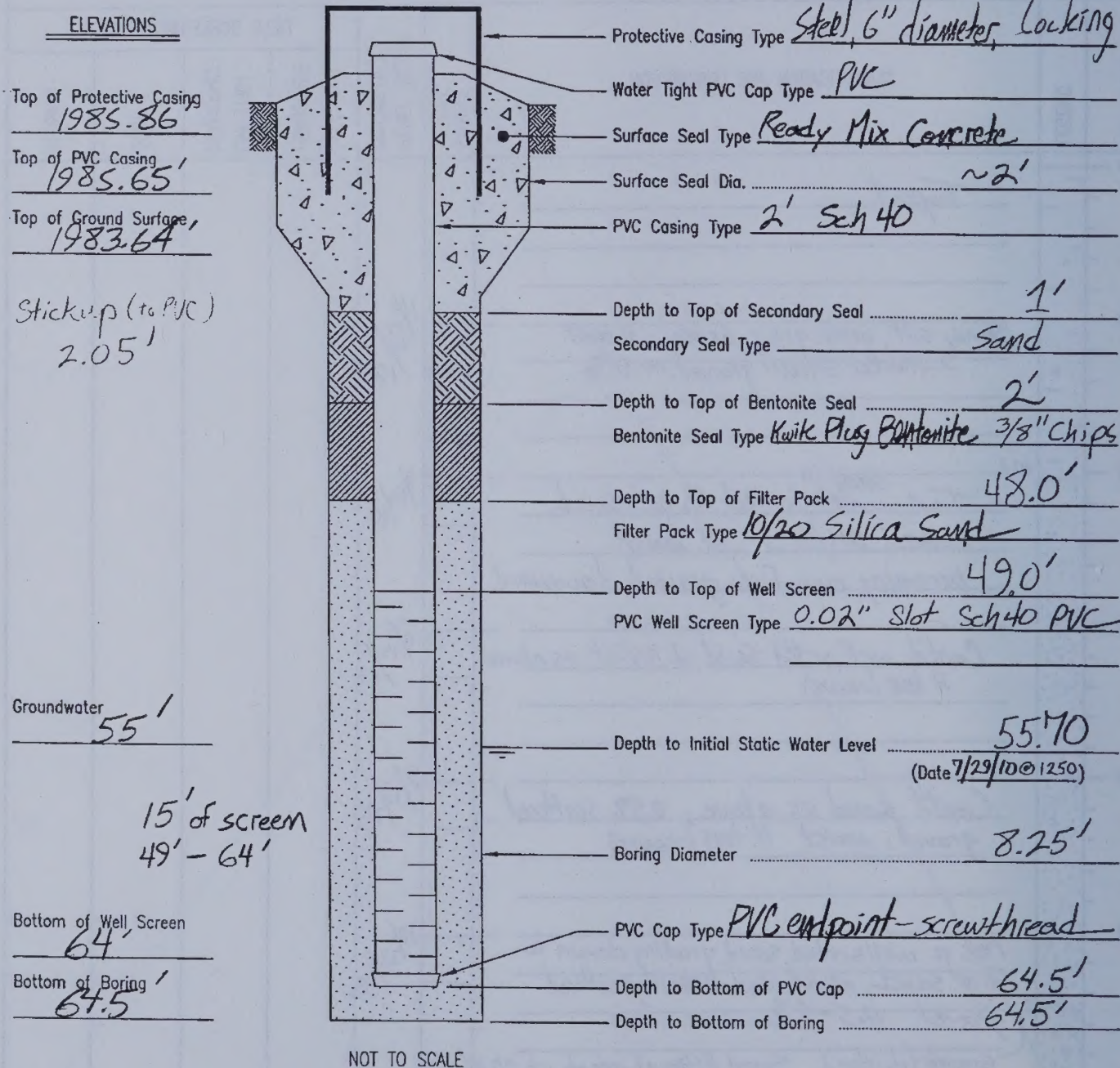
MAT/3-10-98/DRIL-MV, DVG

12
 13
 14
 15
 16

MAXIM
TECHNOLOGIES, INC.

PROJECT: NUMBER: 114-S60133
 NAME: Landfill #102
Richland Co.
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL NO. SL-14
 SHEET 1 OF 1
 LOCATION: _____
 DATE: HOLE STARTED: 7/29/10
 COMPLETED: 7/29/10



NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: 114-560133
 NAME: Landfill #102
Richland Co.
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL/BORING NO. SL-14
 SHEET 2 OF 3
 LOCATION: _____
 ELEVATION: TOP OF HOLE: _____
 (ft) GROUNDWATER: _____
 DATE: STARTED: 7/29/10 COMPLETED: _____
 TIME: STARTED: _____ COMPLETED: _____

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					HNU (PID) HEADSPACE	OVA (FID) HEADSPACE	ODOR	STAINING
30.0		<i>tan, dense sand & gravel, gravel ~25-35% poorly sorted sand, sl. moist</i>		<i>24/43/ 50/5</i>				
35.0		<i>Sand w/ scattered gravel ~1% moist, well to Sand & Gravel 0.2' lens poorly sorted, fine grained</i>		<i>18/33/ 33</i>				
40.0		<i>very moist Sand w/ incr. intervals of sand & Gravel. Clayey Sand & Gravel (0.4') at 40.7' moist. ~1% carbonaceous material in clayey interval</i>		<i>16/24/ 32</i>				
45.0		<i>Sand & Gravel, 25-30% gravel, dense, w/ silty sand, v. moist, lt. brown, (GM) Larger gravels</i>		<i>24/50/5</i>				
50.0		<i>Cont'd Sand & Gravel, moist, w/ silt to sand matrix, ~25-30% gravel, very moist from 50.5'</i>		<i>19/34/ 37</i>				
55.0		<i>fin grained, dense, brown gray sand w/ scattered gravel, gravel ~2-5%, wet Drilling change (driller) gets 'smooth'</i>		<i>14/34/ 44</i>	<i>Water on spoon at 55'</i>			
30.0				<i>20/50/ 12</i>				

CAL = CALIFORNIA
 SS = SPLIT SPOON
 ST = SHELBY TUBE
 DB = DISTURBED BULK /BAG SAMPLE
 CON = CONTINUOUS SAMPLE
 CORE = CORE SAMPLE
 CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
 -- = NOT ANALYZED
 HS = NO SHEEN
 SS = SLIGHT SHEEN
 MS = MODERATE SHEEN
 HS = HEAVY SHEEN
 -- = _____

DEPTH TO BOTTOM OF BORING
64.5'

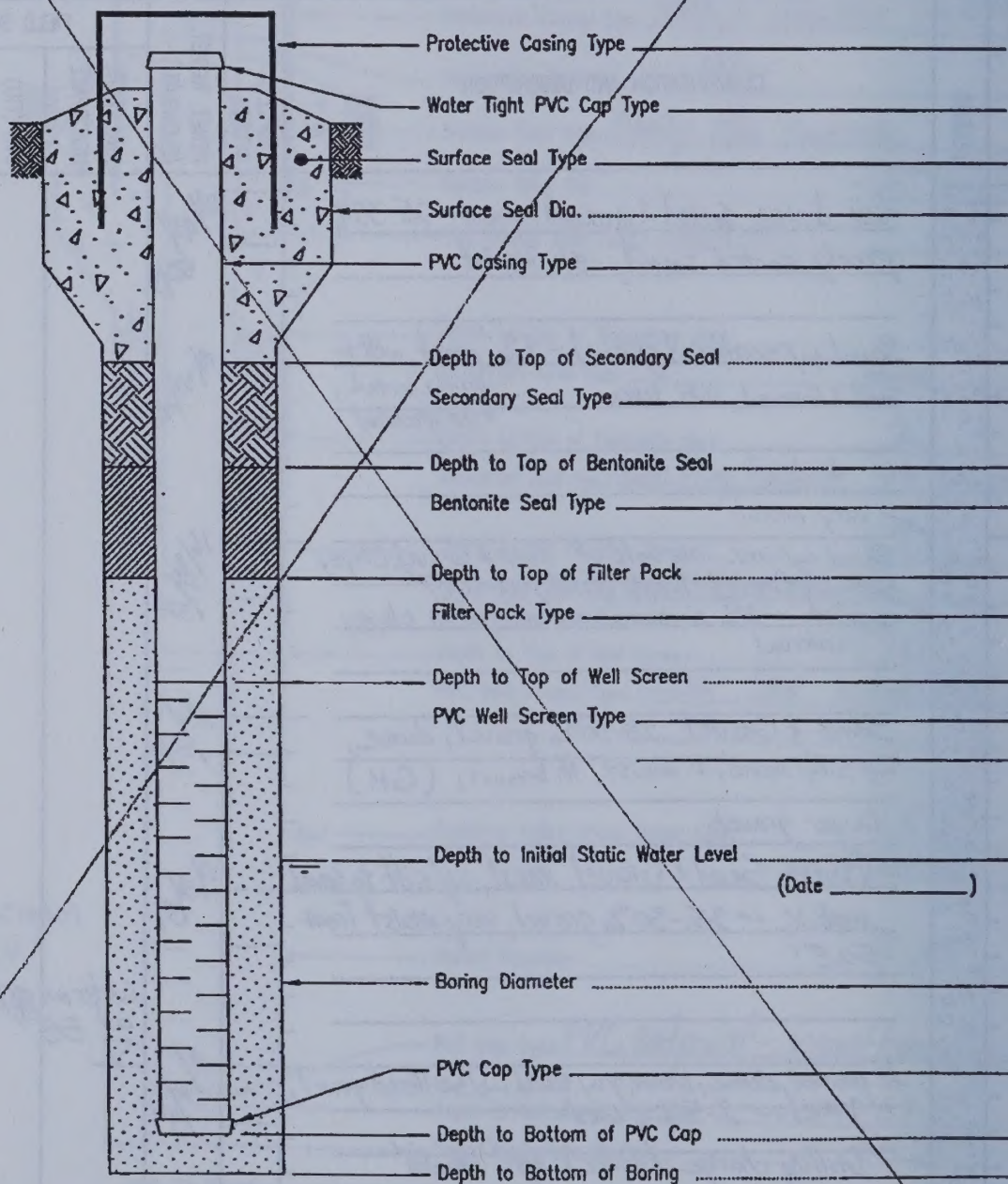


PROJECT: NUMBER: _____
 NAME: _____
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL NO. _____
 SHEET 1 OF 1
 LOCATION: _____
 DATE: HOLE STARTED: _____
 COMPLETED: _____

ELEVATIONS

Top of Protective Casing _____
 Top of PVC Casing _____
 Top of Ground Surface _____



NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: 114-560133
NAME: Landfill #102
Richland Co.

MONITORING WELL/BORING NO. SL-14
SHEET 3 OF 3
LOCATION: _____

DRILL TYPE: SOIL: _____
ROCK: _____
DRILLED BY: _____
LOGGED BY: _____
REMARKS: _____

ELEVATION: TOP OF HOLE: _____
(ft) GROUNDWATER: _____
DATE: STARTED: _____ COMPLETED: _____
TIME: STARTED: _____ COMPLETED: _____

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS				
					HNU (PID) HEADSPACE	OVA (FID) HEADSPACE	ODOR	STAINING	
60.0		Contact w/ Fort Union at 60'							
		Sand & Gravel to 60'. Contact w/ Fort Union: Oxidized Shale - dense turning lt. green at 60.5, moist, spoon to 60.7. Suck up of sands in spoon. Drill down to 64.5' to begin well compl. w/o chance of suck up.		20/50 ₂					
5.0									
		T.D. - 64.5'							
10.0									
15.0									
20.0									
25.0									
30.0									

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK / BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
- = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN

DEPTH TO BOTTOM OF BORING

64.5'

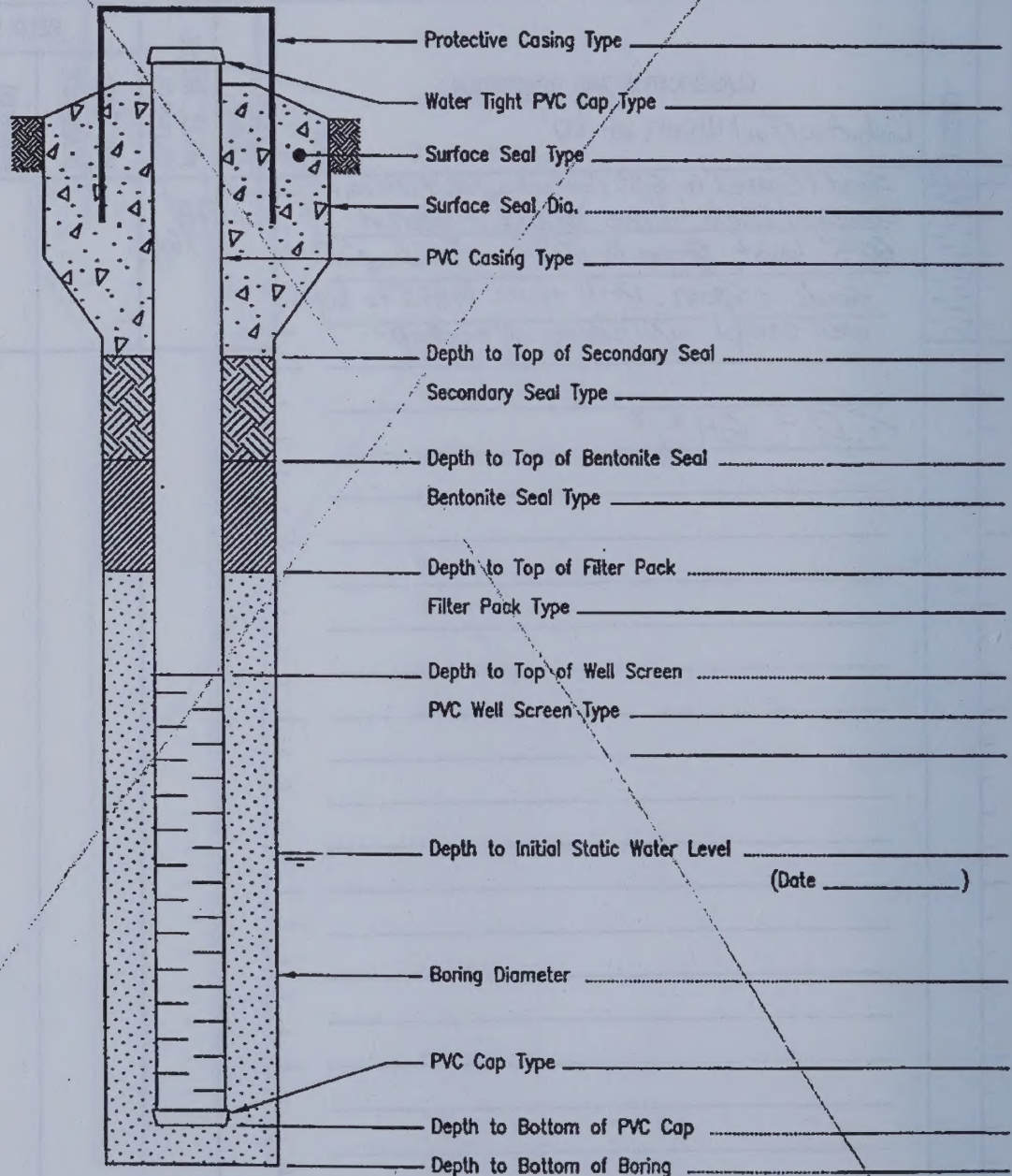
MAXIM
TECHNOLOGIES, INC.

PROJECT: NUMBER: _____
 NAME: _____
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL NO. _____
 SHEET 1 OF 1
 LOCATION: _____
 DATE: HOLE STARTED: _____
 COMPLETED: _____

ELEVATIONS

Top of Protective Casing _____
 Top of PVC Casing _____
 Top of Ground Surface _____



NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: 114-560133
 NAME: Landfill #102
Richland Co.
 DRILL TYPE: SOIL: ✓
 ROCK: ✓
 DRILLED BY: HqzTech HSA BK-81
 LOGGED BY: Mark F. Pearson
 REMARKS: _____

MONITORING WELL/BORING NO. SL-15
 SHEET 1 OF 2
 LOCATION: Last well N and NE of county road #129
 ELEVATION: TOP OF HOLE: 1972.36
 (ft) GROUNDWATER: _____
 DATE: STARTED: 7/29/10 COMPLETED: 7/29/10
 TIME: STARTED: 1330 COMPLETED: 1700

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					HNU (PID) HEADSPACE	OVA (FID) HEADSPACE	ODOR	STAINING
0.0		<u>Topsoil</u>						
5.0		<u>Clayey silt - dark, olive-green, scattered gravel</u> <u>~ 5% moist carbon frag - ~ 0.5%</u> <u>80'</u>		<u>4 1/2</u>				
10.0		<u>Sand - lt. tan-brown, sl. moist, fine grained</u>		<u>7 1/4 / 18</u>				
15.0		<u>Cont'd Sand fine to med grained, tan brown</u> <u>moist carbonaceous silt type at 15.5'</u> <u>(~1" thick), scattered gravel - 0.5%</u>		<u>4 1/5 / 10</u>				
20.0		<u>Sand & Gravel, tan and tan-brown,</u> <u>~ 20% gravel</u>		<u>8 1/5 / 126</u>				
25.0		<u>Sand & Gravel, lt. brown, gravel ~ 10%</u> <u>Sand w/ mud sorting</u>		<u>5 1/6</u>				
30.0								

CAL = CALIFORNIA
 SS = SPLIT SPOON
 ST = SHELLEY TUBE
 DB = DISTURBED BULK / BAG SAMPLE

CON = CONTINUOUS SAMPLE
 CORE = CORE SAMPLE
 CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
 - - = NOT ANALYZED

HS = NO SHEEN
 SS = SLIGHT SHEEN
 MS = MODERATE SHEEN
 HS = HEAVY SHEEN

DEPTH TO BOTTOM OF BORING
50.9'

MAXIM
 TECHNOLOGIES, INC.

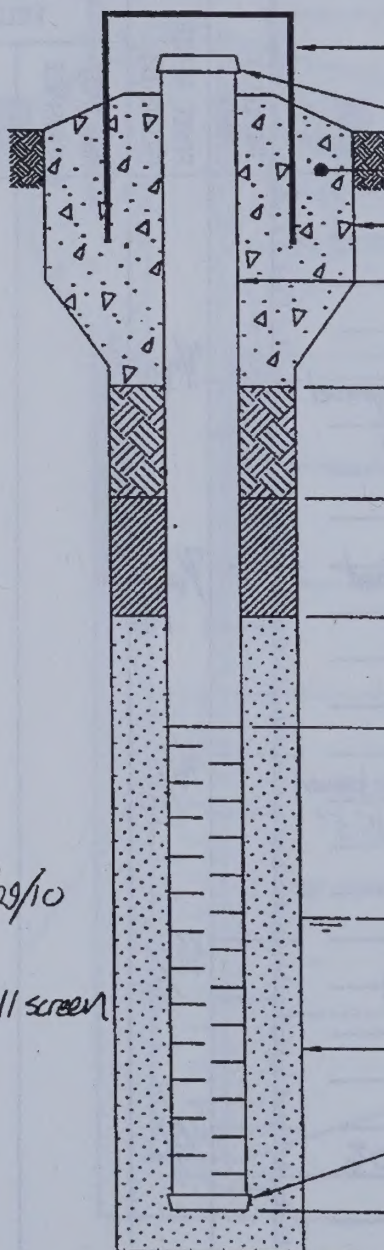
PROJECT: NUMBER: 114-560133
 NAME: Landfill #102
Richland Co.
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL NO. S1-15
 SHEET 1 OF 1
 LOCATION: _____

DATE: HOLE STARTED: 7/29/10
 COMPLETED: 7/29/10

ELEVATIONS

Top of Protective Casing
1974.59
 Top of PVC Casing
1974.32
 Top of Ground Surface
1972.36



Protective Casing Type Steel, 6" diameter, locking

Water Tight PVC Cap Type PVC

Surface Seal Type Ready Mix Concrete

Surface Seal Dia. ~2'

PVC Casing Type 2" Sch 40

Depth to Top of Secondary Seal 1'

Secondary Seal Type Sand

Depth to Top of Bentonite Seal 2'

Bentonite Seal Type Kwik Plug Bentonite 3/8" chips

Depth to Top of Filter Pack 39.0'

Filter Pack Type 10/20 Silica Sand

Depth to Top of Well Screen 40.0'

PVC Well Screen Type 0.02" slot Sch 40 PVC

Depth to Initial Static Water Level Not detected
 (Date 7/29/10)

Boring Diameter 8.25'

PVC Cap Type PVC end point - screwthread

Depth to Bottom of PVC Cap 50.5'

Depth to Bottom of Boring 50.9'

Groundwater
None detected on 7/29/10

10' of well screen
40'-50'

Bottom of Well Screen
50.0'

Bottom of Boring
50.9'

NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

MAXIM
 TECHNOLOGIES, INC.

PROJECT: NUMBER: 114-560133
 NAME: Landfill #102
Richland Co.
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL/BORING NO. SL-15
 SHEET 2 OF 2
 LOCATION: _____
 ELEVATION: TOP OF HOLE: _____
 (ft) GROUNDWATER: _____
 DATE: STARTED: _____ COMPLETED: _____
 TIME: STARTED: _____ COMPLETED: _____

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					HNU (PID) HEADSPACE	OVA (FID) HEADSPACE	ODOR	STAINING
30.0		<i>SL-10 1996.25</i> <i>SL-14 1984.34</i> <i>SL-15 1974.74</i> Sand & Gravel - very moist, brown, dense gravel ~ 25-35%		16/25/34				
35.0		Cont'd Sand and Gravel - tan, sl. moist, dense, gravel ~ 25%		28/49/50/5				
40.0		Cont'd Sand & Gravel - yellow brown to 41.0' ~ 25% gravel, intervals of sand, moist 41.0' on color change to lt. tan-brown		20/34/37				
45.0		Contact w/ Fort Union @ 44.3' Greenish gray silt w/oxidation 'fronfs' throughout dense, moist, finely bedded		15/50/5				
50.0		Change to sand-fine gr. thinly bedded, very consistent thru spoon, sl. moist, tan TD - 50.9'		34/50/5				
55.0								
30.0								

CAL = CALIFORNIA
 SS = SPLIT SPOON
 ST = SHELBY TUBE
 DB = DISTURBED BULK /BAG SAMPLE

CON = CONTINUOUS SAMPLE
 CORE = CORE SAMPLE
 CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
 -- = NOT ANALYZED

NS = NO SHEEN
 SS = SLIGHT SHEEN
 MS = MODERATE SHEEN
 HS = HEAVY SHEEN

DEPTH TO BOTTOM OF BORING
50.9'

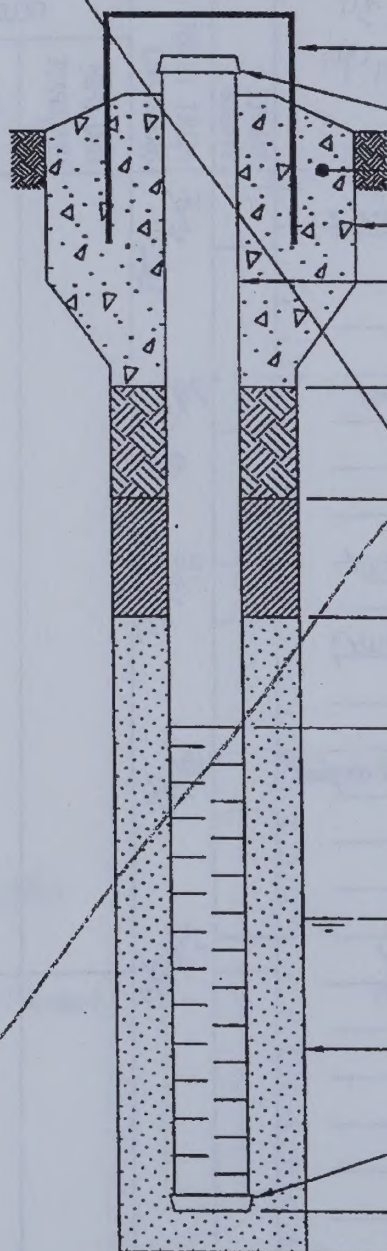
MAXIM
 TECHNOLOGIES, INC.

PROJECT: NUMBER: _____
 NAME: _____
 DRILL TYPE: SOIL: _____
 ROCK: _____
 DRILLED BY: _____
 LOGGED BY: _____
 REMARKS: _____

MONITORING WELL NO. _____
 SHEET 1 OF 1
 LOCATION: _____
 DATE: HOLE STARTED: _____
 COMPLETED: _____

ELEVATIONS

Top of Protective Casing _____
 Top of PVC Casing _____
 Top of Ground Surface _____



Protective Casing Type _____
 Water Tight PVC Cap Type _____
 Surface Seal Type _____
 Surface Seal Dia. _____
 PVC Casing Type _____
 Depth to Top of Secondary Seal _____
 Secondary Seal Type _____
 Depth to Top of Bentonite Seal _____
 Bentonite Seal Type _____
 Depth to Top of Filter Pack _____
 Filter Pack Type _____
 Depth to Top of Well Screen _____
 PVC Well Screen Type _____
 Depth to Initial Static Water Level _____
 (Date _____)
 Boring Diameter _____
 PVC Cap Type _____
 Depth to Bottom of PVC Cap _____
 Depth to Bottom of Boring _____

Groundwater _____
 Bottom of Well Screen _____
 Bottom of Boring _____

NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

ANALYTICAL SUMMARY REPORT

August 15, 2010

Portland County Health Dept
1321 W 100th St
Salem, MT 59725-2000

Investigator: 00000000

Case#: 000000

Animal Name: McManus

Energy Laboratories has received the following 7 samples for analysis from Portland County Health Dept on 08/02/10 for analysis:

Sample ID	Client Sample ID	Collection Date	Received Date	Matrix	Time
00000000-001	SL-10	07/23/10 16:40	08/02/10	Salivary	08/02/10 16:40
00000000-002	SL-11	07/23/10 16:40	08/02/10	Salivary	08/02/10 16:40
00000000-003	SL-12	07/23/10 16:40	08/02/10	Salivary	08/02/10 16:40
00000000-004	SL-13	07/23/10 16:40	08/02/10	Salivary	08/02/10 16:40
00000000-005	Tag	07/23/10 16:40	08/02/10	Salivary	08/02/10 16:40
00000000-006	SL-14	07/23/10 16:40	08/02/10	Salivary	08/02/10 16:40
00000000-007	Tag	07/23/10 16:40	08/02/10	Salivary	08/02/10 16:40

APPENDIX D

Laboratory Reports

The information provided by Energy Laboratories, Inc. is for informational purposes only. It is not intended to be used for legal or regulatory purposes. The information is provided as a service to our clients and is not intended to be used for legal or regulatory purposes. The information is provided as a service to our clients and is not intended to be used for legal or regulatory purposes.

The results are reported only to the client and are not to be used for legal or regulatory purposes.

If you have any questions regarding these results, please call.

Please Approve:



ANALYTICAL SUMMARY REPORT

August 13, 2010

Richland County Health Dept
1201 W Holly St Ste 5
Sidney, MT 59270-3596

Workorder No.: B10080072

Quote ID: B2223

Project Name: Not Indicated

Energy Laboratories Inc received the following 7 samples for Richland County Health Dept on 8/2/2010 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B10080072-001	SL-10	07/27/10 16:40	08/02/10	Aqueous	8260-Volatile Organic Comp, 40 CFR Part 258 App I
B10080072-002	SL-11	07/27/10 18:16	08/02/10	Aqueous	Same As Above
B10080072-003	SL-12	07/28/10 15:55	08/02/10	Aqueous	Same As Above
B10080072-004	SL-13	07/28/10 18:35	08/02/10	Aqueous	Same As Above
B10080072-005	Dup		08/02/10	Aqueous	Same As Above
B10080072-006	SL-14	07/30/10 12:20	08/02/10	Aqueous	Same As Above
B10080072-007	Trip Blank Lot070610 B-TS SHP0250	07/27/10 16:40	08/02/10	Trip Blank	Same As Above

This report was prepared by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project:
Lab ID: B10080072-001
Client Sample ID: SL-10

Report Date: 08/13/10
Collection Date: 07/27/10 16:40
Date Received: 08/02/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	7.8	ug/L	J	20		SW8260B	08/03/10 12:01 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	08/03/10 12:01 / jrj
Benzene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Carbon disulfide	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Chloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Chloroform	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Dichlorodifluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
1,1-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
cis-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
1,2-Dichloropropane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
2-Hexanone	1.3	ug/L	J	20		SW8260B	08/03/10 12:01 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Methyl ethyl ketone	6.3	ug/L	J	20		SW8260B	08/03/10 12:01 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	08/03/10 12:01 / jrj
Methylene chloride	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Styrene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Tetrachloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Toluene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
1,1,1-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Trichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Trichlorofluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj

Report RL - Analyte reporting limit.

Definitions: QCL - Quality control limit.

J - Estimated value. The analyte was present but less than the reporting limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept

Project:

Lab ID: B10080072-001

Client Sample ID: SL-10

Report Date: 08/13/10

Collection Date: 07/27/10 16:40

DateReceived: 08/02/10

Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,2,3-Trichloropropane	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Vinyl acetate	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Vinyl chloride	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
m+p-Xylenes	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
o-Xylene	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Xylenes, Total	ND	ug/L		1.0		SW8260B	08/03/10 12:01 / jrj
Surr: 1,2-Dichloroethane-d4	102	%REC		70-130		SW8260B	08/03/10 12:01 / jrj
Surr: Dibromofluoromethane	106	%REC		77-126		SW8260B	08/03/10 12:01 / jrj
Surr: p-Bromofluorobenzene	105	%REC		76-127		SW8260B	08/03/10 12:01 / jrj
Surr: Toluene-d8	99.0	%REC		79-122		SW8260B	08/03/10 12:01 / jrj

Report RL - Analyte reporting limit.

Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project:
Lab ID: B10080072-002
Client Sample ID: SL-11

Report Date: 08/13/10
Collection Date: 07/27/10 18:16
Date Received: 08/02/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	2.9	ug/L	J	20		SW8260B	08/03/10 12:30 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	08/03/10 12:30 / jrj
Benzene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Carbon disulfide	0.24	ug/L	J	1.0		SW8260B	08/03/10 12:30 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Chloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Chloroform	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Dichlorodifluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
1,1-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
cis-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
1,2-Dichloropropane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
2-Hexanone	ND	ug/L		20		SW8260B	08/03/10 12:30 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Methyl ethyl ketone	2.4	ug/L	J	20		SW8260B	08/03/10 12:30 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	08/03/10 12:30 / jrj
Methylene chloride	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Styrene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Tetrachloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Toluene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
1,1,1-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Trichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj
Trichlorofluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:30 / jrj

Report RL - Analyte reporting limit.

MCL - Maximum contaminant level.

Definitions: QCL - Quality control limit.

ND - Not detected at the reporting limit.

J - Estimated value. The analyte was present but less than the reporting limit.

Report Date: 08/13/10
Collection Date: 07/27/10 18:16
DateReceived: 08/02/10
Matrix: Aqueous

Report Definitions: RL - Analyte reporting limit. MCL - Maximum contaminant level.
QCL - Quality control limit. ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project:
Lab ID: B10080072-003
Client Sample ID: SL-12

Report Date: 08/13/10
Collection Date: 07/28/10 15:55
Date Received: 08/02/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	16	ug/L	J	20		SW8260B	08/03/10 12:59 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	08/03/10 12:59 / jrj
Benzene	0.14	ug/L	J	1.0		SW8260B	08/03/10 12:59 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Carbon disulfide	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Chloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Chloroform	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Dichlorodifluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
1,1-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
cis-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
1,2-Dichloropropane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
2-Hexanone	1.5	ug/L	J	20		SW8260B	08/03/10 12:59 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Methyl ethyl ketone	8.3	ug/L	J	20		SW8260B	08/03/10 12:59 / jrj
Methyl isobutyl ketone	1.6	ug/L	J	20		SW8260B	08/03/10 12:59 / jrj
Methylene chloride	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Styrene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Tetrachloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Toluene	0.23	ug/L	J	1.0		SW8260B	08/03/10 12:59 / jrj
1,1,1-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Trichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Trichlorofluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj

Report RL - Analyte reporting limit.

MCL - Maximum contaminant level.

Definitions: QCL - Quality control limit.

ND - Not detected at the reporting limit.

J - Estimated value. The analyte was present but less than the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project:
Lab ID: B10080072-003
Client Sample ID: SL-12

Report Date: 08/13/10
Collection Date: 07/28/10 15:55
DateReceived: 08/02/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,2,3-Trichloropropane	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Vinyl acetate	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Vinyl chloride	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
m+p-Xylenes	0.20	ug/L	J	1.0		SW8260B	08/03/10 12:59 / jrj
o-Xylene	ND	ug/L		1.0		SW8260B	08/03/10 12:59 / jrj
Xylenes, Total	0.20	ug/L	J	1.0		SW8260B	08/03/10 12:59 / jrj
Surr: 1,2-Dichloroethane-d4	104	%REC		70-130		SW8260B	08/03/10 12:59 / jrj
Surr: Dibromofluoromethane	108	%REC		77-126		SW8260B	08/03/10 12:59 / jrj
Surr: p-Bromofluorobenzene	105	%REC		76-127		SW8260B	08/03/10 12:59 / jrj
Surr: Toluene-d8	104	%REC		79-122		SW8260B	08/03/10 12:59 / jrj

Report Definitions:

- RL - Analyte reporting limit.
- QCL - Quality control limit.
- J - Estimated value. The analyte was present but less than the reporting limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project:
Lab ID: B10080072-004
Client Sample ID: SL-13

Report Date: 08/13/10
Collection Date: 07/28/10 18:35
Date Received: 08/02/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	10	ug/L	J	20		SW8260B	08/03/10 13:27 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	08/03/10 13:27 / jrj
Benzene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Carbon disulfide	0.17	ug/L	J	1.0		SW8260B	08/03/10 13:27 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Chloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Chloroform	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Dichlorodifluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
1,1-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
cis-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
1,2-Dichloropropane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
2-Hexanone	ND	ug/L		20		SW8260B	08/03/10 13:27 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Methyl ethyl ketone	9.7	ug/L	J	20		SW8260B	08/03/10 13:27 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	08/03/10 13:27 / jrj
Methylene chloride	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Styrene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Tetrachloroethene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Toluene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
1,1,1-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Trichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Trichlorofluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj

Report RL - Analyte reporting limit.

MCL - Maximum contaminant level.

Definitions: QCL - Quality control limit.

ND - Not detected at the reporting limit.

J - Estimated value. The analyte was present but less than the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project:
Lab ID: B10080072-004
Client Sample ID: SL-13

Report Date: 08/13/10
Collection Date: 07/28/10 18:35
Date Received: 08/02/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,2,3-Trichloropropane	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Vinyl acetate	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Vinyl chloride	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
m+p-Xylenes	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
o-Xylene	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Xylenes, Total	ND	ug/L		1.0		SW8260B	08/03/10 13:27 / jrj
Surr: 1,2-Dichloroethane-d4	103	%REC		70-130		SW8260B	08/03/10 13:27 / jrj
Surr: Dibromofluoromethane	110	%REC		77-126		SW8260B	08/03/10 13:27 / jrj
Surr: p-Bromofluorobenzene	108	%REC		76-127		SW8260B	08/03/10 13:27 / jrj
Surr: Toluene-d8	104	%REC		79-122		SW8260B	08/03/10 13:27 / jrj

Report Definitions: RL - Analyte reporting limit.
QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project:
Lab ID: B10080072-005
Client Sample ID: Dup

Report Date: 08/13/10
Collection Date: Not Provided
Date Received: 08/02/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	2.2	ug/L	J	20		SW8260B	08/03/10 13:56 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	08/03/10 13:56 / jrj
Benzene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Carbon disulfide	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Chloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Chloroform	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Dichlorodifluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
1,1-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
cis-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
1,2-Dichloropropane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
2-Hexanone	ND	ug/L		20		SW8260B	08/03/10 13:56 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Methyl ethyl ketone	3.7	ug/L	J	20		SW8260B	08/03/10 13:56 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	08/03/10 13:56 / jrj
Methylene chloride	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Styrene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Tetrachloroethene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Toluene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
1,1,1-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Trichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Trichlorofluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

J - Estimated value. The analyte was present but less than the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project:
Lab ID: B10080072-005
Client Sample ID: Dup

Report Date: 08/13/10
Collection Date: Not Provided
Date Received: 08/02/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,2,3-Trichloropropane	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Vinyl acetate	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Vinyl chloride	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
m+p-Xylenes	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
o-Xylene	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Xylenes, Total	ND	ug/L		1.0		SW8260B	08/03/10 13:56 / jrj
Surr: 1,2-Dichloroethane-d4	102	%REC		70-130		SW8260B	08/03/10 13:56 / jrj
Surr: Dibromofluoromethane	108	%REC		77-126		SW8260B	08/03/10 13:56 / jrj
Surr: p-Bromofluorobenzene	104	%REC		76-127		SW8260B	08/03/10 13:56 / jrj
Surr: Toluene-d8	98.0	%REC		79-122		SW8260B	08/03/10 13:56 / jrj

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project:
Lab ID: B10080072-006
Client Sample ID: SL-14

Report Date: 08/13/10
Collection Date: 07/30/10 12:20
Date Received: 08/02/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	3.1	ug/L	J	20		SW8260B	08/03/10 14:25 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	08/03/10 14:25 / jrj
Benzene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Carbon disulfide	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Chloroethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Chloroform	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Dichlorodifluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
1,1-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
cis-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
1,2-Dichloropropane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
2-Hexanone	ND	ug/L		20		SW8260B	08/03/10 14:25 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Methyl ethyl ketone	3.4	ug/L	J	20		SW8260B	08/03/10 14:25 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	08/03/10 14:25 / jrj
Methylene chloride	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Styrene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Tetrachloroethene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Toluene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
1,1,1-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Trichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj
Trichlorofluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 14:25 / jrj

Report RL - Analyte reporting limit.

MCL - Maximum contaminant level.

Definitions: QCL - Quality control limit.

ND - Not detected at the reporting limit.

J - Estimated value. The analyte was present but less than the reporting limit.

RT

Report Date: 08/13/10
Collection Date: 07/30/10 12:20
DateReceived: 08/02/10
Matrix: Aqueous

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project:
Lab ID: B10080072-007
Client Sample ID: Trip Blank Lot070610 B-TS SHP0250

Report Date: 08/13/10
Collection Date: 07/27/10 16:40
Date Received: 08/02/10
Matrix: Trip Blank

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	ND	ug/L		20		SW8260B	08/03/10 11:32 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	08/03/10 11:32 / jrj
Benzene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Carbon disulfide	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Chloroethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Chloroform	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Dichlorodifluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
1,1-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
cis-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
1,2-Dichloropropane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
2-Hexanone	ND	ug/L		20		SW8260B	08/03/10 11:32 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Methyl ethyl ketone	ND	ug/L		20		SW8260B	08/03/10 11:32 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	08/03/10 11:32 / jrj
Methylene chloride	1.8	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Styrene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Tetrachloroethene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Toluene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
1,1,1-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Trichloroethene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Trichlorofluoromethane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Report Date: 08/13/10
Collection Date: 07/27/10 16:40
DateReceived: 08/02/10
Matrix: Trip Blank

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,2,3-Trichloropropane	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Vinyl acetate	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Vinyl chloride	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
m+p-Xylenes	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
o-Xylene	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Xylenes, Total	ND	ug/L		1.0		SW8260B	08/03/10 11:32 / jrj
Surr: 1,2-Dichloroethane-d4	100	%REC		70-130		SW8260B	08/03/10 11:32 / jrj
Surr: Dibromofluoromethane	107	%REC		77-126		SW8260B	08/03/10 11:32 / jrj
Surr: p-Bromofluorobenzene	104	%REC		76-127		SW8260B	08/03/10 11:32 / jrj
Surr: Toluene-d8	102	%REC		79-122		SW8260B	08/03/10 11:32 / jrj

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

QA/QC Summary Report

Client: Richland County Health Dept

Report Date: 08/13/10

Project:

Work Order: B10080072

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8260B							Batch: R151735		
Sample ID: Ics080310	Laboratory Control Sample				Run: SV5972.I_100803A		08/03/10 10:35		
Acetone	44.8	ug/L	20	90	62	130			
Acrylonitrile	48.0	ug/L	20	96	60	130			
Benzene	5.32	ug/L	1.0	106	71	133			
Bromochloromethane	5.24	ug/L	1.0	105	68	131			
Bromodichloromethane	5.24	ug/L	1.0	105	67	138			
Bromoform	5.28	ug/L	1.0	106	64	136			
Bromomethane	6.16	ug/L	1.0	123	60	138			
Carbon disulfide	4.88	ug/L	1.0	98	46	145			
Carbon tetrachloride	5.48	ug/L	1.0	110	61	144			
Chlorobenzene	5.16	ug/L	1.0	103	78	136			
Chlorodibromomethane	5.36	ug/L	1.0	107	72	136			
Chloroethane	5.44	ug/L	1.0	109	64	136			
Chloroform	5.24	ug/L	1.0	105	69	133			
Chloromethane	5.92	ug/L	1.0	118	63	149			
1,2-Dibromo-3-chloropropane	5.12	ug/L	1.0	102	63	125			
1,2-Dibromoethane	5.12	ug/L	1.0	102	75	131			
Dibromomethane	5.12	ug/L	1.0	102	72	133			
1,2-Dichlorobenzene	5.16	ug/L	1.0	103	78	129			
1,4-Dichlorobenzene	5.20	ug/L	1.0	104	78	131			
trans-1,4-Dichloro-2-butene	4.88	ug/L	1.0	98	50	142			
Dichlorodifluoromethane	6.28	ug/L	1.0	126	55	141			
1,1-Dichloroethane	5.48	ug/L	1.0	110	72	130			
1,2-Dichloroethane	5.20	ug/L	1.0	104	57	146			
1,1-Dichloroethene	5.80	ug/L	1.0	116	66	142			
cis-1,2-Dichloroethene	5.20	ug/L	1.0	104	74	133			
trans-1,2-Dichloroethene	5.40	ug/L	1.0	108	76	138			
1,2-Dichloropropane	5.24	ug/L	1.0	105	72	135			
cis-1,3-Dichloropropene	5.28	ug/L	1.0	106	75	132			
trans-1,3-Dichloropropene	5.84	ug/L	1.0	117	77	145			
Ethylbenzene	5.32	ug/L	1.0	106	78	131			
2-Hexanone	46.8	ug/L	20	94	72	131			
Iodomethane	5.60	ug/L	1.0	112	66	132			
Methyl ethyl ketone	46.8	ug/L	20	94	55	145			
Methyl isobutyl ketone	46.4	ug/L	20	93	73	129			
Methylene chloride	4.92	ug/L	1.0	98	73	126			
Styrene	5.16	ug/L	1.0	103	76	134			
1,1,1,2-Tetrachloroethane	5.12	ug/L	1.0	102	75	135			
1,1,2,2-Tetrachloroethane	5.32	ug/L	1.0	106	72	132			
Tetrachloroethene	5.20	ug/L	1.0	104	78	137			
Toluene	5.24	ug/L	1.0	105	78	134			
1,1,1-Trichloroethane	5.40	ug/L	1.0	108	64	141			
1,1,2-Trichloroethane	4.92	ug/L	1.0	98	72	133			
Trichloroethene	5.20	ug/L	1.0	104	75	138			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Client: Richland County Health Dept

Report Date: 08/13/10

Project:

Work Order: B10080072

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8260B							Batch: R151735		
Sample ID: lcs080310			Laboratory Control Sample			Run: SV5972.I_100803A			08/03/10 10:35
Trichlorofluoromethane	5.36	ug/L	1.0	107	58	139			
1,2,3-Trichloropropane	4.76	ug/L	1.0	95	67	133			
Vinyl acetate	4.00	ug/L	1.0	80	31	124			
Vinyl chloride	5.16	ug/L	1.0	103	66	140			
m+p-Xylenes	10.3	ug/L	1.0	103	78	133			
o-Xylene	5.28	ug/L	1.0	106	79	136			
Surr: 1,2-Dichloroethane-d4			1.0	100	70	130			
Surr: Dibromofluoromethane			1.0	104	77	126			
Surr: p-Bromofluorobenzene			1.0	106	76	127			
Surr: Toluene-d8			1.0	103	79	122			
Sample ID: blk080310			Method Blank			Run: SV5972.I_100803A			08/03/10 11:03
Acetone	ND	ug/L	20						
Acrylonitrile	ND	ug/L	20						
Benzene	ND	ug/L	1.0						
Bromochloromethane	ND	ug/L	1.0						
Bromodichloromethane	ND	ug/L	1.0						
Bromoform	ND	ug/L	1.0						
Bromomethane	ND	ug/L	1.0						
Carbon disulfide	ND	ug/L	1.0						
Carbon tetrachloride	ND	ug/L	1.0						
Chlorobenzene	ND	ug/L	1.0						
Chlorodibromomethane	ND	ug/L	1.0						
Chloroethane	ND	ug/L	1.0						
Chloroform	ND	ug/L	1.0						
Chloromethane	ND	ug/L	1.0						
1,2-Dibromo-3-chloropropane	ND	ug/L	1.0						
1,2-Dibromoethane	ND	ug/L	1.0						
Dibromomethane	ND	ug/L	1.0						
1,2-Dichlorobenzene	ND	ug/L	1.0						
1,4-Dichlorobenzene	ND	ug/L	1.0						
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0						
Dichlorodifluoromethane	ND	ug/L	1.0						
1,1-Dichloroethane	ND	ug/L	1.0						
1,2-Dichloroethane	ND	ug/L	1.0						
1,1-Dichloroethene	ND	ug/L	1.0						
cis-1,2-Dichloroethene	ND	ug/L	1.0						
trans-1,2-Dichloroethene	ND	ug/L	1.0						
1,2-Dichloropropane	ND	ug/L	1.0						
cis-1,3-Dichloropropene	ND	ug/L	1.0						
trans-1,3-Dichloropropene	ND	ug/L	1.0						
Ethylbenzene	ND	ug/L	1.0						
2-Hexanone	ND	ug/L	20						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Client: Richland County Health Dept

Report Date: 08/13/10

Project:

Work Order: B10080072

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8260B							Batch: R151735		
Sample ID: blk080310	Method Blank		Run: SV5972.I_100803A				08/03/10 11:03		
Iodomethane	ND	ug/L	1.0						
Methyl ethyl ketone	ND	ug/L	20						
Methyl isobutyl ketone	ND	ug/L	20						
Methylene chloride	ND	ug/L	1.0						
Styrene	ND	ug/L	1.0						
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0						
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0						
Tetrachloroethene	ND	ug/L	1.0						
Toluene	ND	ug/L	1.0						
1,1,1-Trichloroethane	ND	ug/L	1.0						
1,1,2-Trichloroethane	ND	ug/L	1.0						
Trichloroethene	ND	ug/L	1.0						
Trichlorofluoromethane	ND	ug/L	1.0						
1,2,3-Trichloropropane	ND	ug/L	1.0						
Vinyl acetate	ND	ug/L	1.0						
Vinyl chloride	ND	ug/L	1.0						
m+p-Xylenes	ND	ug/L	1.0						
o-Xylene	ND	ug/L	1.0						
Xylenes, Total	ND	ug/L	1.0						
Surr: 1,2-Dichloroethane-d4			1.0	101	70	130			
Surr: Dibromofluoromethane			1.0	107	77	126			
Surr: p-Bromofluorobenzene			1.0	106	76	127			
Surr: Toluene-d8			1.0	104	79	122			
Sample ID: B10080072-001AMS	Sample Matrix Spike		Run: SV5972.I_100803A				08/03/10 15:04		
Acetone	56.0	ug/L	20	96	62	130			
Acrylonitrile	52.8	ug/L	20	106	60	130			
Benzene	5.64	ug/L	1.0	113	71	133			
Bromochloromethane	5.60	ug/L	1.0	112	68	131			
Bromodichloromethane	5.40	ug/L	1.0	108	67	138			
Bromoform	5.36	ug/L	1.0	107	64	136			
Bromomethane	7.24	ug/L	1.0	145	60	138			S
Carbon disulfide	5.16	ug/L	1.0	103	46	145			
Carbon tetrachloride	5.84	ug/L	1.0	117	61	144			
Chlorobenzene	5.40	ug/L	1.0	108	78	136			
Chlorodibromomethane	5.60	ug/L	1.0	112	72	136			
Chloroethane	5.80	ug/L	1.0	116	64	136			
Chloroform	5.60	ug/L	1.0	112	69	133			
Chloromethane	6.60	ug/L	1.0	132	63	149			
1,2-Dibromo-3-chloropropane	5.28	ug/L	1.0	106	63	125			
1,2-Dibromoethane	5.36	ug/L	1.0	107	75	131			
Dibromomethane	5.44	ug/L	1.0	109	72	133			
1,2-Dichlorobenzene	5.44	ug/L	1.0	109	78	129			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Client: Richland County Health Dept

Report Date: 08/13/10

Project:

Work Order: B10080072

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8260B							Batch: R151735		
Sample ID: B10080072-001AMS	Sample Matrix Spike		Run: SV5972.I_100803A				08/03/10 15:04		
1,4-Dichlorobenzene	5.44	ug/L	1.0	109	78	131			
trans-1,4-Dichloro-2-butene	5.08	ug/L	1.0	102	50	142			
Dichlorodifluoromethane	6.52	ug/L	1.0	130	55	141			
1,1-Dichloroethane	5.68	ug/L	1.0	114	72	130			
1,2-Dichloroethane	5.72	ug/L	1.0	114	57	146			
1,1-Dichloroethene	5.92	ug/L	1.0	118	66	142			
cis-1,2-Dichloroethene	5.52	ug/L	1.0	110	74	133			
trans-1,2-Dichloroethene	5.56	ug/L	1.0	111	76	138			
1,2-Dichloropropane	5.48	ug/L	1.0	110	72	135			
cis-1,3-Dichloropropene	5.52	ug/L	1.0	110	75	132			
trans-1,3-Dichloropropene	6.00	ug/L	1.0	120	77	145			
Ethylbenzene	5.48	ug/L	1.0	110	78	131			
2-Hexanone	52.4	ug/L	20	102	72	131			
Iodomethane	6.16	ug/L	1.0	123	66	132			
Methyl ethyl ketone	56.4	ug/L	20	100	55	145			
Methyl isobutyl ketone	51.2	ug/L	20	100	73	129			
Methylene chloride	5.16	ug/L	1.0	103	73	126			
Styrene	3.92	ug/L	1.0	78	76	134			
1,1,1,2-Tetrachloroethane	5.44	ug/L	1.0	109	75	135			
1,1,2,2-Tetrachloroethane	5.60	ug/L	1.0	112	72	132			
Tetrachloroethene	5.68	ug/L	1.0	114	78	137			
Toluene	5.40	ug/L	1.0	108	78	134			
1,1,1-Trichloroethane	5.80	ug/L	1.0	116	64	141			
1,1,2-Trichloroethane	5.28	ug/L	1.0	106	72	133			
Trichloroethene	5.40	ug/L	1.0	108	75	138			
Trichlorofluoromethane	5.76	ug/L	1.0	115	58	139			
1,2,3-Trichloropropane	4.96	ug/L	1.0	99	67	133			
Vinyl acetate	4.80	ug/L	1.0	96	31	124			
Vinyl chloride	5.40	ug/L	1.0	108	66	140			
m+p-Xylenes	10.2	ug/L	1.0	102	78	133			
o-Xylene	5.32	ug/L	1.0	106	79	136			
Surr: 1,2-Dichloroethane-d4			1.0	102	70	130			
Surr: Dibromofluoromethane			1.0	108	77	126			
Surr: p-Bromofluorobenzene			1.0	103	76	127			
Surr: Toluene-d8			1.0	102	79	122			
Sample ID: B10080072-001AMSD	Sample Matrix Spike Duplicate		Run: SV5972.I_100803A				08/03/10 15:33		
Acetone	59.2	ug/L	20	103	62	130	5.6	20	
Acrylonitrile	54.4	ug/L	20	109	60	130	3	20	
Benzene	5.72	ug/L	1.0	114	71	133	1.4	20	
Bromochloromethane	5.72	ug/L	1.0	114	68	131	2.1	20	
Bromodichloromethane	5.60	ug/L	1.0	112	67	138	3.6	20	
Bromoform	5.60	ug/L	1.0	112	64	136	4.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Client: Richland County Health Dept

Report Date: 08/13/10

Project:

Work Order: B10080072

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8260B							Batch: R151735		
Sample ID: B10080072-001AMSD	Sample Matrix Spike Duplicate			Run: SV5972.I_100803A			08/03/10 15:33		
Bromomethane	7.84	ug/L	1.0	157	60	138	8	20	S
Carbon disulfide	5.28	ug/L	1.0	106	46	145	2.3	20	
Carbon tetrachloride	6.04	ug/L	1.0	121	61	144	3.4	20	
Chlorobenzene	5.52	ug/L	1.0	110	78	136	2.2	20	
Chlorodibromomethane	5.80	ug/L	1.0	116	72	136	3.5	20	
Chloroethane	5.92	ug/L	1.0	118	64	136	2	20	
Chloroform	5.68	ug/L	1.0	114	69	133	1.4	20	
Chloromethane	6.88	ug/L	1.0	138	63	149	4.2	20	
1,2-Dibromo-3-chloropropane	5.60	ug/L	1.0	112	63	125	5.9	20	
1,2-Dibromoethane	5.60	ug/L	1.0	112	75	131	4.4	20	
Dibromomethane	5.68	ug/L	1.0	114	72	133	4.3	20	
1,2-Dichlorobenzene	5.68	ug/L	1.0	114	78	129	4.3	20	
1,4-Dichlorobenzene	5.64	ug/L	1.0	113	78	131	3.6	20	
trans-1,4-Dichloro-2-butene	5.44	ug/L	1.0	109	50	142	6.8	20	
Dichlorodifluoromethane	6.96	ug/L	1.0	139	55	141	6.5	20	
1,1-Dichloroethane	5.72	ug/L	1.0	114	72	130	0.7	20	
1,2-Dichloroethane	5.84	ug/L	1.0	117	57	146	2.1	20	
1,1-Dichloroethene	6.00	ug/L	1.0	120	66	142	1.3	20	
cis-1,2-Dichloroethene	5.72	ug/L	1.0	114	74	133	3.6	20	
trans-1,2-Dichloroethene	5.60	ug/L	1.0	112	76	138	0.7	20	
1,2-Dichloropropane	5.52	ug/L	1.0	110	72	135	0.7	20	
cis-1,3-Dichloropropene	5.64	ug/L	1.0	113	75	132	2.2	20	
trans-1,3-Dichloropropene	6.08	ug/L	1.0	122	77	145	1.3	20	
Ethylbenzene	5.56	ug/L	1.0	111	78	131	1.4	20	
2-Hexanone	54.4	ug/L	20	106	72	131	3.7	20	
Iodomethane	6.60	ug/L	1.0	132	66	132	6.9	20	
Methyl ethyl ketone	58.8	ug/L	20	105	55	145	4.2	20	
Methyl isobutyl ketone	53.6	ug/L	20	105	73	129	4.6	20	
Methylene chloride	5.08	ug/L	1.0	102	73	126	1.6	20	
Styrene	4.04	ug/L	1.0	81	76	134	3.1	20	
1,1,1,2-Tetrachloroethane	5.64	ug/L	1.0	113	75	135	3.6	20	
1,1,2,2-Tetrachloroethane	5.88	ug/L	1.0	118	72	132	4.9	20	
Tetrachloroethene	5.92	ug/L	1.0	118	78	137	4.1	20	
Toluene	5.52	ug/L	1.0	110	78	134	2.2	20	
1,1,1-Trichloroethane	5.80	ug/L	1.0	116	64	141	0	20	
1,1,2-Trichloroethane	5.36	ug/L	1.0	107	72	133	1.5	20	
Trichloroethene	5.56	ug/L	1.0	111	75	138	2.9	20	
Trichlorofluoromethane	6.08	ug/L	1.0	122	58	139	5.4	20	
1,2,3-Trichloropropane	5.04	ug/L	1.0	101	67	133	1.6	20	
Vinyl acetate	5.00	ug/L	1.0	100	31	124	4.1	20	
Vinyl chloride	5.60	ug/L	1.0	112	66	140	3.6	20	
m+p-Xylenes	10.3	ug/L	1.0	103	78	133	1.2	20	
o-Xylene	5.40	ug/L	1.0	108	79	136	1.5	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Client: Richland County Health Dept

Report Date: 08/13/10

Project:

Work Order: B10080072

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
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Method: SW8260B

Batch: R151735

Sample ID: B10080072-001AMSD

Sample Matrix Spike Duplicate

Run: SV5972.I_100803A

08/03/10 15:33

Surr: 1,2-Dichloroethane-d4	1.0	102	70	130
Surr: Dibromofluoromethane	1.0	108	77	126
Surr: p-Bromofluorobenzene	1.0	106	76	127
Surr: Toluene-d8	1.0	103	79	122

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Workorder Receipt Checklist



Richland County Health Dept

B10080072

Login completed by: Leslie S. Cadreau

Date Received: 8/2/2010

Reviewed by: BL2000\kmcDonald

Received by: Isc

Reviewed Date: 8/3/2010

Carrier name: Hand Del

Shipping container/cooler in good condition?	Yes ☒	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☒
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☒
Chain of custody present?	Yes ☒	No ☐	
Chain of custody signed when relinquished and received?	Yes ☒	No ☐	
Chain of custody agrees with sample labels?	Yes ☒	No ☐	
Samples in proper container/bottle?	Yes ☒	No ☐	
Sample containers intact?	Yes ☒	No ☐	
Sufficient sample volume for indicated test?	Yes ☒	No ☐	
All samples received within holding time?	Yes ☒	No ☐	
Container/Temp Blank temperature:	3°C On Ice		
Water - VOA vials have zero headspace?	Yes ☒	No ☐	No VOA vials submitted ☐
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☒

Contact and Corrective Action Comments:

None



Chain of Custody and Analytical Request Record

Page ____ of ____

PLEASE PRINT (Provide as much information as possible.)

Company Name: Richland County		Project Name, PWS, Permit, Etc. Kelly Logan		Sample Origin State:		EPA/State Compliance: Yes ☐ No ☐	
Report Mail Address: 1201 West Holly Suite 5		Contact Name: 433-6876		Phone/Fax: KLlogan@richland.org		Email: KLlogan@richland.org	
Invoice Address: S. Hwy MT 59270		Invoice Contact & Phone: Land CU 102		Purchase Order:		Quote/Bottle Order:	
Special Report/Formats: ☐ DW ☐ POTW/WWTP ☐ State: ☐ Other: ☐ EDD/EDT (Electronic Data) Format: _____ ☐ LEVEL IV ☐ NELAC		Number of Containers Sample Type: A W S V B O DW Air Water Soils/Solids Vegetation Bioassay Other DW - Drinking Water UVC's 8260		ANALYSIS REQUESTED SEE ATTACHED		Contact ELI prior to RUSH sample submittal for charges and scheduling - See Instruction Page Comments:	
SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)		Collection Date	Collection Time	MATRIX	Standard Turnaround (TAT)	Shipped by: Hand Cooler ID(s):	
1 SL-10		7-27	1640	W		Receipt Temp 3 °C	
2 SL-11		7-27	1816	1		On Ice: ☒ Y ☐ N	
3 SL-12		7-28	1555			Custody Seal On Bottle Y ☒ N On Cooler Y ☒ N	
4 SL-13		7-28	1935			Intact Y ☒ N	
5 DWP						Signature Match Y ☒ N	
6 SL-14		7-30	1220				
7 TB 7-6-10		TS	0250				
8							
9							
10							
Custody Record MUST be Signed	Relinquished by (print): Kelly Logan	Date/Time: 9-2-2010	Signature:	Received by (print):	Date/Time:	Signature:	
	Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:	
	Sample Disposal:	Return to Client:	Lab Disposal:	Received by Laboratory: Lisa Cadeaux	Date/Time: 8-2-10 13:25	Signature:	

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.

Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

ANALYTICAL SUMMARY REPORT

August 05, 2010

Richland County Health Dept
1201 W Holly St Ste 5
Sidney, MT 59270-3596

Workorder No.: B10072483

Project Name: Landfill #102

Energy Laboratories Inc received the following 8 samples for Richland County Health Dept on 7/27/2010 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B10072483-001	SL-3	07/25/10 18:00	07/27/10	Aqueous	8260-Volatile Organic Comp, 40 CFR Part 258 App I
B10072483-002	SL-4	07/25/10 14:45	07/27/10	Aqueous	Same As Above
B10072483-003	SL-6	07/25/10 13:00	07/27/10	Aqueous	Same As Above
B10072483-004	SL-7	07/24/10 17:01	07/27/10	Aqueous	Same As Above
B10072483-005	SL-8	07/24/10 17:54	07/27/10	Aqueous	Same As Above
B10072483-006	SL-9	07/24/10 15:00	07/27/10	Aqueous	Same As Above
B10072483-007	DUP	07/25/10 0:00	07/27/10	Aqueous	Same As Above
B10072483-008	Trip Blank Lot #070810, B- GC SHO 250	07/24/10 15:00	07/27/10	Trip Blank	Same As Above

This report was prepared by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-001
Client Sample ID: SL-3

Report Date: 08/05/10
Collection Date: 07/25/10 18:00
Date Received: 07/27/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	ND	ug/L		20		SW8260B	07/29/10 14:20 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	07/29/10 14:20 / jrj
Benzene	0.54	ug/L	J	1.0		SW8260B	07/29/10 14:20 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Carbon disulfide	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Chloroethane	0.33	ug/L	J	1.0		SW8260B	07/29/10 14:20 / jrj
Chloroform	1.1	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Dichlorodifluoromethane	3.6	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
1,1-Dichloroethane	3.5	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
cis-1,2-Dichloroethene	2.9	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
1,2-Dichloropropane	0.54	ug/L	J	1.0		SW8260B	07/29/10 14:20 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
2-Hexanone	ND	ug/L		20		SW8260B	07/29/10 14:20 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Methyl ethyl ketone	ND	ug/L		20		SW8260B	07/29/10 14:20 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	07/29/10 14:20 / jrj
Methylene chloride	0.22	ug/L	JT	1.0		SW8260B	07/29/10 14:20 / jrj
Styrene	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Tetrachloroethene	7.8	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Toluene	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
1,1,1-Trichloroethane	1.6	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Trichloroethene	1.2	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Trichlorofluoromethane	0.91	ug/L	J	1.0		SW8260B	07/29/10 14:20 / jrj

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.
T - The analyte was detected in the associated trip blank.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
J - Estimated value. The analyte was present but less than the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-001
Client Sample ID: SL-3

Report Date: 08/05/10
Collection Date: 07/25/10 18:00
Date Received: 07/27/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,2,3-Trichloropropane	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Vinyl acetate	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Vinyl chloride	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
m+p-Xylenes	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
o-Xylene	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Xylenes, Total	ND	ug/L		1.0		SW8260B	07/29/10 14:20 / jrj
Surr: 1,2-Dichloroethane-d4	102	%REC		70-130		SW8260B	07/29/10 14:20 / jrj
Surr: Dibromofluoromethane	107	%REC		77-126		SW8260B	07/29/10 14:20 / jrj
Surr: p-Bromofluorobenzene	106	%REC		76-127		SW8260B	07/29/10 14:20 / jrj
Surr: Toluene-d8	103	%REC		79-122		SW8260B	07/29/10 14:20 / jrj

Report Definitions: RL - Analyte reporting limit.
QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-002
Client Sample ID: SL-4

Report Date: 08/05/10
Collection Date: 07/25/10 14:45
Date Received: 07/27/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	ND	ug/L		20		SW8260B	07/29/10 13:52 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	07/29/10 13:52 / jrj
Benzene	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Carbon disulfide	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Chloroethane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Chloroform	0.70	ug/L	J	1.0		SW8260B	07/29/10 13:52 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Dichlorodifluoromethane	0.35	ug/L	J	1.0		SW8260B	07/29/10 13:52 / jrj
1,1-Dichloroethane	0.22	ug/L	J	1.0		SW8260B	07/29/10 13:52 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
cis-1,2-Dichloroethene	0.32	ug/L	J	1.0		SW8260B	07/29/10 13:52 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
1,2-Dichloropropane	0.54	ug/L	J	1.0		SW8260B	07/29/10 13:52 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
2-Hexanone	ND	ug/L		20		SW8260B	07/29/10 13:52 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Methyl ethyl ketone	ND	ug/L		20		SW8260B	07/29/10 13:52 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	07/29/10 13:52 / jrj
Methylene chloride	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Styrene	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Tetrachloroethene	21	ug/L		2.0		SW8260B	07/29/10 16:15 / jrj
Toluene	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
1,1,1-Trichloroethane	0.25	ug/L	J	1.0		SW8260B	07/29/10 13:52 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 13:52 / jrj
Trichloroethene	0.51	ug/L	J	1.0		SW8260B	07/29/10 13:52 / jrj
Trichlorofluoromethane	0.33	ug/L	J	1.0		SW8260B	07/29/10 13:52 / jrj

Report RL - Analyte reporting limit.

MCL - Maximum contaminant level.

Definitions: QCL - Quality control limit.

ND - Not detected at the reporting limit.

J - Estimated value. The analyte was present but less than the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-002
Client Sample ID: SL-4

Report Date: 08/05/10
Collection Date: 07/25/10 14:45
DateReceived: 07/27/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,2,3-Trichloropropane	ND	ug/L		1.0	CM	SW8260B	07/29/10 13:52 / jrj
Vinyl acetate	ND	ug/L		1.0	CM	SW8260B	07/29/10 13:52 / jrj
Vinyl chloride	ND	ug/L		1.0	CM	SW8260B	07/29/10 13:52 / jrj
m+p-Xylenes	ND	ug/L		1.0	CM	SW8260B	07/29/10 13:52 / jrj
o-Xylene	ND	ug/L		1.0	CM	SW8260B	07/29/10 13:52 / jrj
Xylenes, Total	ND	ug/L		1.0	CM	SW8260B	07/29/10 13:52 / jrj
Surr: 1,2-Dichloroethane-d4	101	%REC		70-130	CM	SW8260B	07/29/10 13:52 / jrj
Surr: Dibromofluoromethane	105	%REC		77-126	CM	SW8260B	07/29/10 13:52 / jrj
Surr: p-Bromofluorobenzene	105	%REC		76-127	CM	SW8260B	07/29/10 13:52 / jrj
Surr: Toluene-d8	102	%REC		79-122	CM	SW8260B	07/29/10 13:52 / jrj

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-003
Client Sample ID: SL-6

Report Date: 08/05/10
Collection Date: 07/25/10 13:00
Date Received: 07/27/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	ND	ug/L		20		SW8260B	07/29/10 13:23 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	07/29/10 13:23 / jrj
Benzene	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Carbon disulfide	0.20	ug/L	JT	1.0		SW8260B	07/29/10 13:23 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Chloroethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Chloroform	0.44	ug/L	J	1.0		SW8260B	07/29/10 13:23 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Dichlorodifluoromethane	0.43	ug/L	J	1.0		SW8260B	07/29/10 13:23 / jrj
1,1-Dichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
cis-1,2-Dichloroethene	0.38	ug/L	J	1.0		SW8260B	07/29/10 13:23 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
1,2-Dichloropropane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
2-Hexanone	ND	ug/L		20		SW8260B	07/29/10 13:23 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Methyl ethyl ketone	ND	ug/L		20		SW8260B	07/29/10 13:23 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	07/29/10 13:23 / jrj
Methylene chloride	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Styrene	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Tetrachloroethene	20	ug/L		2.0		SW8260B	07/29/10 15:46 / jrj
Toluene	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
1,1,1-Trichloroethane	0.28	ug/L	J	1.0		SW8260B	07/29/10 13:23 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Trichloroethene	0.47	ug/L	J	1.0		SW8260B	07/29/10 13:23 / jrj
Trichlorofluoromethane	0.26	ug/L	J	1.0		SW8260B	07/29/10 13:23 / jrj

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.
T - The analyte was detected in the associated trip blank.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
J - Estimated value. The analyte was present but less than the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-003
Client Sample ID: SL-6

Report Date: 08/05/10
Collection Date: 07/25/10 13:00
DateReceived: 07/27/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,2,3-Trichloropropane	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Vinyl acetate	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Vinyl chloride	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
m+p-Xylenes	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
o-Xylene	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Xylenes, Total	ND	ug/L		1.0		SW8260B	07/29/10 13:23 / jrj
Surr: 1,2-Dichloroethane-d4	103	%REC		70-130		SW8260B	07/29/10 13:23 / jrj
Surr: Dibromofluoromethane	107	%REC		77-126		SW8260B	07/29/10 13:23 / jrj
Surr: p-Bromofluorobenzene	107	%REC		76-127		SW8260B	07/29/10 13:23 / jrj
Surr: Toluene-d8	102	%REC		79-122		SW8260B	07/29/10 13:23 / jrj

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-004
Client Sample ID: SL-7

Report Date: 08/05/10
Collection Date: 07/24/10 17:01
Date Received: 07/27/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	ND	ug/L		20		SW8260B	07/29/10 12:54 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	07/29/10 12:54 / jrj
Benzene	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Carbon disulfide	0.23	ug/L	JT	1.0		SW8260B	07/29/10 12:54 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Chloroethane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Chloroform	0.37	ug/L	J	1.0		SW8260B	07/29/10 12:54 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Dichlorodifluoromethane	0.43	ug/L	J	1.0		SW8260B	07/29/10 12:54 / jrj
1,1-Dichloroethane	0.65	ug/L	J	1.0		SW8260B	07/29/10 12:54 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
cis-1,2-Dichloroethene	0.28	ug/L	J	1.0		SW8260B	07/29/10 12:54 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
1,2-Dichloropropane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
2-Hexanone	ND	ug/L		20		SW8260B	07/29/10 12:54 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Methyl ethyl ketone	ND	ug/L		20		SW8260B	07/29/10 12:54 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	07/29/10 12:54 / jrj
Methylene chloride	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Styrene	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Tetrachloroethene	26	ug/L		2.0		SW8260B	07/29/10 14:49 / jrj
Toluene	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
1,1,1-Trichloroethane	2.8	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Trichloroethene	0.69	ug/L	J	1.0		SW8260B	07/29/10 12:54 / jrj
Trichlorofluoromethane	1.2	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.
T - The analyte was detected in the associated trip blank.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
J - Estimated value. The analyte was present but less than the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-004
Client Sample ID: SL-7

Report Date: 08/05/10
Collection Date: 07/24/10 17:01
DateReceived: 07/27/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,2,3-Trichloropropane	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Vinyl acetate	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Vinyl chloride	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
m+p-Xylenes	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
o-Xylene	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Xylenes, Total	ND	ug/L		1.0		SW8260B	07/29/10 12:54 / jrj
Surr: 1,2-Dichloroethane-d4	100	%REC		70-130		SW8260B	07/29/10 12:54 / jrj
Surr: Dibromofluoromethane	106	%REC		77-126		SW8260B	07/29/10 12:54 / jrj
Surr: p-Bromofluorobenzene	104	%REC		76-127		SW8260B	07/29/10 12:54 / jrj
Surr: Toluene-d8	102	%REC		79-122		SW8260B	07/29/10 12:54 / jrj

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-005
Client Sample ID: SL-8

Report Date: 08/05/10
Collection Date: 07/24/10 17:54
Date Received: 07/27/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	ND	ug/L		20		SW8260B	07/29/10 12:25 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	07/29/10 12:25 / jrj
Benzene	0.39	ug/L	J	1.0		SW8260B	07/29/10 12:25 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Carbon disulfide	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Chloroethane	0.43	ug/L	J	1.0		SW8260B	07/29/10 12:25 / jrj
Chloroform	0.78	ug/L	J	1.0		SW8260B	07/29/10 12:25 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Dichlorodifluoromethane	0.33	ug/L	J	1.0		SW8260B	07/29/10 12:25 / jrj
1,1-Dichloroethane	2.1	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
cis-1,2-Dichloroethene	0.87	ug/L	J	1.0		SW8260B	07/29/10 12:25 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
1,2-Dichloropropane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
2-Hexanone	ND	ug/L		20		SW8260B	07/29/10 12:25 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Methyl ethyl ketone	ND	ug/L		20		SW8260B	07/29/10 12:25 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	07/29/10 12:25 / jrj
Methylene chloride	2.7	ug/L	T	1.0		SW8260B	07/29/10 12:25 / jrj
Styrene	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Tetrachloroethene	19	ug/L		2.0		SW8260B	07/29/10 15:18 / jrj
Toluene	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
1,1,1-Trichloroethane	1.9	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Trichloroethene	0.76	ug/L	J	1.0		SW8260B	07/29/10 12:25 / jrj
Trichlorofluoromethane	0.52	ug/L	J	1.0		SW8260B	07/29/10 12:25 / jrj

Report RL - Analyte reporting limit.

Definitions: QCL - Quality control limit.

T - The analyte was detected in the associated trip blank.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

J - Estimated value. The analyte was present but less than the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-005
Client Sample ID: SL-8

Report Date: 08/05/10
Collection Date: 07/24/10 17:54
DateReceived: 07/27/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,2,3-Trichloropropane	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Vinyl acetate	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Vinyl chloride	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
m+p-Xylenes	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
o-Xylene	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Xylenes, Total	ND	ug/L		1.0		SW8260B	07/29/10 12:25 / jrj
Surr: 1,2-Dichloroethane-d4	104	%REC		70-130		SW8260B	07/29/10 12:25 / jrj
Surr: Dibromofluoromethane	108	%REC		77-126		SW8260B	07/29/10 12:25 / jrj
Surr: p-Bromofluorobenzene	107	%REC		76-127		SW8260B	07/29/10 12:25 / jrj
Surr: Toluene-d8	101	%REC		79-122		SW8260B	07/29/10 12:25 / jrj

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-006
Client Sample ID: SL-9

Report Date: 08/05/10
Collection Date: 07/24/10 15:00
Date Received: 07/27/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	ND	ug/L		20		SW8260B	07/29/10 11:57 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	07/29/10 11:57 / jrj
Benzene	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Carbon disulfide	0.22	ug/L	JT	1.0		SW8260B	07/29/10 11:57 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Chloroethane	0.27	ug/L	J	1.0		SW8260B	07/29/10 11:57 / jrj
Chloroform	1.0	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Dichlorodifluoromethane	1.7	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
1,1-Dichloroethane	4.0	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
cis-1,2-Dichloroethene	2.1	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
1,2-Dichloropropane	0.40	ug/L	J	1.0		SW8260B	07/29/10 11:57 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
2-Hexanone	ND	ug/L		20		SW8260B	07/29/10 11:57 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Methyl ethyl ketone	ND	ug/L		20		SW8260B	07/29/10 11:57 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	07/29/10 11:57 / jrj
Methylene chloride	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Styrene	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Tetrachloroethene	9.0	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Toluene	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
1,1,1-Trichloroethane	1.4	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Trichloroethene	0.90	ug/L	J	1.0		SW8260B	07/29/10 11:57 / jrj
Trichlorofluoromethane	0.56	ug/L	J	1.0		SW8260B	07/29/10 11:57 / jrj

Report RL - Analyte reporting limit.

Definitions: QCL - Quality control limit.

T - The analyte was detected in the associated trip blank.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

J - Estimated value. The analyte was present but less than the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-006
Client Sample ID: SL-9

Report Date: 08/05/10
Collection Date: 07/24/10 15:00
DateReceived: 07/27/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,2,3-Trichloropropane	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Vinyl acetate	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Vinyl chloride	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
m+p-Xylenes	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
o-Xylene	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Xylenes, Total	ND	ug/L		1.0		SW8260B	07/29/10 11:57 / jrj
Surr: 1,2-Dichloroethane-d4	102	%REC		70-130		SW8260B	07/29/10 11:57 / jrj
Surr: Dibromofluoromethane	107	%REC		77-126		SW8260B	07/29/10 11:57 / jrj
Surr: p-Bromofluorobenzene	108	%REC		76-127		SW8260B	07/29/10 11:57 / jrj
Surr: Toluene-d8	103	%REC		79-122		SW8260B	07/29/10 11:57 / jrj

Report Definitions: RL - Analyte reporting limit.
QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-007
Client Sample ID: DUP

Report Date: 08/05/10
Collection Date: 07/25/10
Date Received: 07/27/10
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	ND	ug/L		20		SW8260B	07/29/10 11:28 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	07/29/10 11:28 / jrj
Benzene	0.69	ug/L	J	1.0		SW8260B	07/29/10 11:28 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Carbon disulfide	0.40	ug/L	JT	1.0		SW8260B	07/29/10 11:28 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Chloroethane	0.51	ug/L	J	1.0		SW8260B	07/29/10 11:28 / jrj
Chloroform	1.4	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Dichlorodifluoromethane	4.8	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
1,1-Dichloroethane	4.7	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
1,1-Dichloroethene	0.14	ug/L	J	1.0		SW8260B	07/29/10 11:28 / jrj
cis-1,2-Dichloroethene	3.8	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
1,2-Dichloropropane	0.73	ug/L	J	1.0		SW8260B	07/29/10 11:28 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
2-Hexanone	ND	ug/L		20		SW8260B	07/29/10 11:28 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Methyl ethyl ketone	ND	ug/L		20		SW8260B	07/29/10 11:28 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	07/29/10 11:28 / jrj
Methylene chloride	0.30	ug/L	JT	1.0		SW8260B	07/29/10 11:28 / jrj
Styrene	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Tetrachloroethene	10	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Toluene	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
1,1,1-Trichloroethane	2.0	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Trichloroethene	1.5	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj
Trichlorofluoromethane	1.1	ug/L		1.0		SW8260B	07/29/10 11:28 / jrj

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.
T - The analyte was detected in the associated trip blank.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
J - Estimated value. The analyte was present but less than the reporting limit.

Report Date: 08/05/10
Collection Date: 07/25/10
DateReceived: 07/27/10
Matrix: Aqueous

Report Definitions: RL - Analyte reporting limit, MCL - Maximum contaminant level.
QCL - Quality control limit, ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-008
Client Sample ID: Trip Blank Lot #070810, B-GC SHO 250

Report Date: 08/05/10
Collection Date: 07/24/10 15:00
Date Received: 07/27/10
Matrix: Trip Blank

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
Acetone	ND	ug/L		20		SW8260B	07/29/10 10:59 / jrj
Acrylonitrile	ND	ug/L		20		SW8260B	07/29/10 10:59 / jrj
Benzene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Bromochloromethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Bromodichloromethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Bromoform	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Bromomethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Carbon disulfide	0.38	ug/L	J	1.0		SW8260B	07/29/10 10:59 / jrj
Carbon tetrachloride	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Chlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Chlorodibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Chloroethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Chloroform	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Chloromethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
1,2-Dibromoethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Dibromomethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
1,2-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
1,4-Dichlorobenzene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
trans-1,4-Dichloro-2-butene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Dichlorodifluoromethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
1,1-Dichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
1,2-Dichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
1,1-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
cis-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
trans-1,2-Dichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
1,2-Dichloropropane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
cis-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
trans-1,3-Dichloropropene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Ethylbenzene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
2-Hexanone	ND	ug/L		20		SW8260B	07/29/10 10:59 / jrj
Iodomethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Methyl ethyl ketone	ND	ug/L		20		SW8260B	07/29/10 10:59 / jrj
Methyl isobutyl ketone	ND	ug/L		20		SW8260B	07/29/10 10:59 / jrj
Methylene chloride	0.24	ug/L	J	1.0		SW8260B	07/29/10 10:59 / jrj
Styrene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
1,1,1,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
1,1,2,2-Tetrachloroethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Tetrachloroethene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Toluene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
1,1,1-Trichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
1,1,2-Trichloroethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Trichloroethene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Trichlorofluoromethane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj

Report Definitions:
 RL - Analyte reporting limit.
 QCL - Quality control limit.
 J - Estimated value. The analyte was present but less than the reporting limit.
 MCL - Maximum contaminant level.
 ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Richland County Health Dept
Project: Landfill #102
Lab ID: B10072483-008
Client Sample ID: Trip Blank Lot #070810, B-GC SHO 250

Report Date: 08/05/10
Collection Date: 07/24/10 15:00
DateReceived: 07/27/10
Matrix: Trip Blank

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,2,3-Trichloropropane	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Vinyl acetate	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Vinyl chloride	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
m+p-Xylenes	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
o-Xylene	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Xylenes, Total	ND	ug/L		1.0		SW8260B	07/29/10 10:59 / jrj
Surr: 1,2-Dichloroethane-d4	100	%REC		70-130		SW8260B	07/29/10 10:59 / jrj
Surr: Dibromofluoromethane	105	%REC		77-126		SW8260B	07/29/10 10:59 / jrj
Surr: p-Bromofluorobenzene	104	%REC		76-127		SW8260B	07/29/10 10:59 / jrj
Surr: Toluene-d8	98.0	%REC		79-122		SW8260B	07/29/10 10:59 / jrj

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

QA/QC Summary Report

Client: Richland County Health Dept

Report Date: 08/05/10

Project: Landfill #102

Work Order: B10072483

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8260B									
Batch: R151480									
Sample ID: lcs072910	Laboratory Control Sample				Run: SV5972.I_100729A		07/29/10 10:01		
Acetone	49.2	ug/L	20	98	62	130			
Acrylonitrile	59.2	ug/L	20	118	60	130			
Benzene	5.32	ug/L	1.0	106	71	133			
Bromochloromethane	4.84	ug/L	1.0	97	68	131			
Bromodichloromethane	4.84	ug/L	1.0	97	67	138			
Bromoform	5.04	ug/L	1.0	101	64	136			
Bromomethane	6.16	ug/L	1.0	123	60	138			
Carbon disulfide	5.92	ug/L	1.0	118	46	145			
Carbon tetrachloride	5.16	ug/L	1.0	103	61	144			
Chlorobenzene	4.72	ug/L	1.0	94	78	136			
Chlorodibromomethane	4.84	ug/L	1.0	97	72	136			
Chloroethane	5.84	ug/L	1.0	117	64	136			
Chloroform	5.08	ug/L	1.0	102	69	133			
Chloromethane	6.32	ug/L	1.0	126	63	149			
1,2-Dibromo-3-chloropropane	4.44	ug/L	1.0	89	63	125			
1,2-Dibromoethane	4.64	ug/L	1.0	93	75	131			
Dibromomethane	4.80	ug/L	1.0	96	72	133			
1,2-Dichlorobenzene	4.92	ug/L	1.0	98	78	129			
1,4-Dichlorobenzene	4.88	ug/L	1.0	98	78	131			
trans-1,4-Dichloro-2-butene	5.84	ug/L	1.0	117	50	142			
Dichlorodifluoromethane	6.08	ug/L	1.0	122	55	141			
1,1-Dichloroethane	5.20	ug/L	1.0	104	72	130			
1,2-Dichloroethane	5.04	ug/L	1.0	101	57	146			
1,1-Dichloroethene	5.44	ug/L	1.0	109	66	142			
cis-1,2-Dichloroethene	4.92	ug/L	1.0	98	74	133			
trans-1,2-Dichloroethene	5.12	ug/L	1.0	102	76	138			
1,2-Dichloropropane	5.04	ug/L	1.0	101	72	135			
cis-1,3-Dichloropropene	5.08	ug/L	1.0	102	75	132			
trans-1,3-Dichloropropene	5.48	ug/L	1.0	110	77	145			
Ethylbenzene	4.88	ug/L	1.0	98	78	131			
2-Hexanone	51.2	ug/L	20	102	72	131			
Iodomethane	6.28	ug/L	1.0	126	66	132			
Methyl ethyl ketone	53.2	ug/L	20	106	55	145			
Methyl isobutyl ketone	50.8	ug/L	20	102	73	129			
Methylene chloride	4.84	ug/L	1.0	97	73	126			
Styrene	4.80	ug/L	1.0	96	76	134			
1,1,1,2-Tetrachloroethane	4.80	ug/L	1.0	96	75	135			
1,1,2,2-Tetrachloroethane	5.16	ug/L	1.0	103	72	132			
Tetrachloroethene	4.76	ug/L	1.0	95	78	137			
Toluene	4.64	ug/L	1.0	93	78	134			
1,1,1-Trichloroethane	5.04	ug/L	1.0	101	64	141			
1,1,2-Trichloroethane	4.76	ug/L	1.0	95	72	133			
Trichloroethene	4.84	ug/L	1.0	97	75	138			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Client: Richland County Health Dept

Report Date: 08/05/10

Project: Landfill #102

Work Order: B10072483

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8260B							Batch: R151480		
Sample ID: lcs072910	Laboratory Control Sample				Run: SV5972.I_100729A		07/29/10 10:01		
Trichlorofluoromethane	5.56	ug/L	1.0	111	58	139			
1,2,3-Trichloropropane	4.48	ug/L	1.0	90	67	133			
Vinyl acetate	5.28	ug/L	1.0	106	31	124			
Vinyl chloride	5.60	ug/L	1.0	112	66	140			
m+p-Xylenes	9.76	ug/L	1.0	98	78	133			
o-Xylene	4.88	ug/L	1.0	98	79	136			
Surr: 1,2-Dichloroethane-d4			1.0	102	70	130			
Surr: Dibromofluoromethane			1.0	105	77	126			
Surr: p-Bromofluorobenzene			1.0	107	76	127			
Surr: Toluene-d8			1.0	100	79	122			
Sample ID: blk072910	Method Blank				Run: SV5972.I_100729A		07/29/10 10:30		
Acetone	ND	ug/L	20						
Acrylonitrile	ND	ug/L	20						
Benzene	ND	ug/L	1.0						
Bromochloromethane	ND	ug/L	1.0						
Bromodichloromethane	ND	ug/L	1.0						
Bromoform	ND	ug/L	1.0						
Bromomethane	ND	ug/L	1.0						
Carbon disulfide	ND	ug/L	1.0						
Carbon tetrachloride	ND	ug/L	1.0						
Chlorobenzene	ND	ug/L	1.0						
Chlorodibromomethane	ND	ug/L	1.0						
Chloroethane	ND	ug/L	1.0						
Chloroform	ND	ug/L	1.0						
Chloromethane	ND	ug/L	1.0						
1,2-Dibromo-3-chloropropane	ND	ug/L	1.0						
1,2-Dibromoethane	ND	ug/L	1.0						
Dibromomethane	ND	ug/L	1.0						
1,2-Dichlorobenzene	ND	ug/L	1.0						
1,4-Dichlorobenzene	ND	ug/L	1.0						
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0						
Dichlorodifluoromethane	ND	ug/L	1.0						
1,1-Dichloroethane	ND	ug/L	1.0						
1,2-Dichloroethane	ND	ug/L	1.0						
1,1-Dichloroethene	ND	ug/L	1.0						
cis-1,2-Dichloroethene	ND	ug/L	1.0						
trans-1,2-Dichloroethene	ND	ug/L	1.0						
1,2-Dichloropropane	ND	ug/L	1.0						
cis-1,3-Dichloropropene	ND	ug/L	1.0						
trans-1,3-Dichloropropene	ND	ug/L	1.0						
Ethylbenzene	ND	ug/L	1.0						
2-Hexanone	ND	ug/L	20						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Client: Richland County Health Dept

Report Date: 08/05/10

Project: Landfill #102

Work Order: B10072483

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8260B									
Batch: R151480									
Sample ID: blk072910	Method Blank		Run: SV5972.I_100729A			07/29/10 10:30			
Iodomethane	ND	ug/L	1.0						
Methyl ethyl ketone	ND	ug/L	20						
Methyl isobutyl ketone	ND	ug/L	20						
Methylene chloride	ND	ug/L	1.0						
Styrene	ND	ug/L	1.0						
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0						
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0						
Tetrachloroethene	ND	ug/L	1.0						
Toluene	ND	ug/L	1.0						
1,1,1-Trichloroethane	ND	ug/L	1.0						
1,1,2-Trichloroethane	ND	ug/L	1.0						
Trichloroethene	ND	ug/L	1.0						
Trichlorofluoromethane	ND	ug/L	1.0						
1,2,3-Trichloropropane	ND	ug/L	1.0						
Vinyl acetate	ND	ug/L	1.0						
Vinyl chloride	ND	ug/L	1.0						
m+p-Xylenes	ND	ug/L	1.0						
o-Xylene	ND	ug/L	1.0						
Xylenes, Total	ND	ug/L	1.0						
Surr: 1,2-Dichloroethane-d4			1.0	102	70	130			
Surr: Dibromofluoromethane			1.0	108	77	126			
Surr: p-Bromofluorobenzene			1.0	104	76	127			
Surr: Toluene-d8			1.0	102	79	122			
Sample ID: b10072483-006ams									
Sample Matrix Spike		Run: SV5972.I_100729A			07/29/10 16:43				
Acetone	51.6	ug/L	20	103	62	130			
Acrylonitrile	54.4	ug/L	20	109	60	130			
Benzene	5.20	ug/L	1.0	104	71	133			
Bromochloromethane	5.16	ug/L	1.0	103	68	131			
Bromodichloromethane	5.12	ug/L	1.0	102	67	138			
Bromoform	5.28	ug/L	1.0	106	64	136			
Bromomethane	5.68	ug/L	1.0	114	60	138			
Carbon disulfide	4.80	ug/L	1.0	92	46	145			
Carbon tetrachloride	5.20	ug/L	1.0	104	61	144			
Chlorobenzene	5.04	ug/L	1.0	101	78	136			
Chlorodibromomethane	5.32	ug/L	1.0	106	72	136			
Chloroethane	5.68	ug/L	1.0	108	64	136			
Chloroform	6.16	ug/L	1.0	103	69	133			
Chloromethane	5.88	ug/L	1.0	118	63	149			
1,2-Dibromo-3-chloropropane	5.12	ug/L	1.0	102	63	125			
1,2-Dibromoethane	5.20	ug/L	1.0	104	75	131			
Dibromomethane	5.28	ug/L	1.0	106	72	133			
1,2-Dichlorobenzene	5.12	ug/L	1.0	102	78	129			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Client: Richland County Health Dept

Report Date: 08/05/10

Project: Landfill #102

Work Order: B10072483

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8260B							Batch: R151480		
Sample ID: b10072483-006ams	Sample Matrix Spike		Run: SV5972.I_100729A				07/29/10 16:43		
1,4-Dichlorobenzene	5.00	ug/L	1.0	100	78	131			
trans-1,4-Dichloro-2-butene	5.24	ug/L	1.0	105	50	142			
Dichlorodifluoromethane	7.48	ug/L	1.0	117	55	141			
1,1-Dichloroethane	8.88	ug/L	1.0	98	72	130			
1,2-Dichloroethane	5.44	ug/L	1.0	109	57	146			
1,1-Dichloroethene	5.36	ug/L	1.0	107	66	142			
cis-1,2-Dichloroethene	7.20	ug/L	1.0	103	74	133			
trans-1,2-Dichloroethene	5.16	ug/L	1.0	103	76	138			
1,2-Dichloropropane	5.60	ug/L	1.0	104	72	135			
cis-1,3-Dichloropropene	5.28	ug/L	1.0	106	75	132			
trans-1,3-Dichloropropene	5.68	ug/L	1.0	114	77	145			
Ethylbenzene	5.08	ug/L	1.0	102	78	131			
2-Hexanone	52.8	ug/L	20	106	72	131			
Iodomethane	5.76	ug/L	1.0	115	66	132			
Methyl ethyl ketone	52.4	ug/L	20	105	55	145			
Methyl isobutyl ketone	52.4	ug/L	20	105	73	129			
Methylene chloride	4.80	ug/L	1.0	96	73	126			
Styrene	4.28	ug/L	1.0	86	76	134			
1,1,1,2-Tetrachloroethane	5.04	ug/L	1.0	101	75	135			
1,1,2,2-Tetrachloroethane	5.52	ug/L	1.0	110	72	132			
Tetrachloroethene	14.1	ug/L	1.0	102	78	137			
Toluene	5.08	ug/L	1.0	102	78	134			
1,1,1-Trichloroethane	6.52	ug/L	1.0	103	64	141			
1,1,2-Trichloroethane	5.12	ug/L	1.0	102	72	133			
Trichloroethene	5.88	ug/L	1.0	100	75	138			
Trichlorofluoromethane	5.92	ug/L	1.0	107	58	139			
1,2,3-Trichloropropane	4.92	ug/L	1.0	98	67	133			
Vinyl acetate	4.84	ug/L	1.0	97	31	124			
Vinyl chloride	5.16	ug/L	1.0	103	66	140			
m+p-Xylenes	9.68	ug/L	1.0	97	78	133			
o-Xylene	5.04	ug/L	1.0	101	79	136			
Surr: 1,2-Dichloroethane-d4			1.0	103	70	130			
Surr: Dibromofluoromethane			1.0	108	77	126			
Surr: p-Bromofluorobenzene			1.0	106	76	127			
Surr: Toluene-d8			1.0	102	79	122			
Sample ID: b10072483-006amsd	Sample Matrix Spike Duplicate		Run: SV5972.I_100729A				07/29/10 17:12		
Acetone	51.6	ug/L	20	103	62	130	0	20	
Acrylonitrile	55.6	ug/L	20	111	60	130	2.2	20	
Benzene	5.04	ug/L	1.0	101	71	133	3.1	20	
Bromochloromethane	5.12	ug/L	1.0	102	68	131	0.8	20	
Bromodichloromethane	5.00	ug/L	1.0	100	67	138	2.4	20	
Bromoform	5.24	ug/L	1.0	105	64	136	0.8	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Client: Richland County Health Dept

Report Date: 08/05/10

Project: Landfill #102

Work Order: B10072483

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8260B							Batch: R151480		
Sample ID: b10072483-006amsd	Sample Matrix Spike Duplicate			Run: SV5972.I_100729A			07/29/10 17:12		
Bromomethane	6.88	ug/L	1.0	138	60	138	19	20	
Carbon disulfide	4.80	ug/L	1.0	92	46	145	0	20	
Carbon tetrachloride	5.00	ug/L	1.0	100	61	144	3.9	20	
Chlorobenzene	4.88	ug/L	1.0	98	78	136	3.2	20	
Chlorodibromomethane	5.16	ug/L	1.0	103	72	136	3.1	20	
Chloroethane	5.80	ug/L	1.0	111	64	136	2.1	20	
Chloroform	6.00	ug/L	1.0	100	69	133	2.6	20	
Chloromethane	6.28	ug/L	1.0	126	63	149	6.6	20	
1,2-Dibromo-3-chloropropane	5.48	ug/L	1.0	110	63	125	6.8	20	
1,2-Dibromoethane	5.12	ug/L	1.0	102	75	131	1.6	20	
Dibromomethane	5.12	ug/L	1.0	102	72	133	3.1	20	
1,2-Dichlorobenzene	4.92	ug/L	1.0	98	78	129	4	20	
1,4-Dichlorobenzene	4.96	ug/L	1.0	99	78	131	0.8	20	
trans-1,4-Dichloro-2-butene	5.48	ug/L	1.0	110	50	142	4.5	20	
Dichlorodifluoromethane	7.36	ug/L	1.0	114	55	141	1.6	20	
1,1-Dichloroethane	8.88	ug/L	1.0	98	72	130	0	20	
1,2-Dichloroethane	5.24	ug/L	1.0	105	57	146	3.7	20	
1,1-Dichloroethene	5.20	ug/L	1.0	104	66	142	3	20	
cis-1,2-Dichloroethene	7.08	ug/L	1.0	101	74	133	1.7	20	
trans-1,2-Dichloroethene	4.92	ug/L	1.0	98	76	138	4.8	20	
1,2-Dichloropropane	5.48	ug/L	1.0	102	72	135	2.2	20	
cis-1,3-Dichloropropene	5.12	ug/L	1.0	102	75	132	3.1	20	
trans-1,3-Dichloropropene	5.60	ug/L	1.0	112	77	145	1.4	20	
Ethylbenzene	4.84	ug/L	1.0	97	78	131	4.8	20	
2-Hexanone	54.0	ug/L	20	108	72	131	2.2	20	
Iodomethane	6.00	ug/L	1.0	120	66	132	4.1	20	
Methyl ethyl ketone	52.8	ug/L	20	106	55	145	0.8	20	
Methyl isobutyl ketone	52.4	ug/L	20	105	73	129	0	20	
Methylene chloride	4.76	ug/L	1.0	95	73	126	0.8	20	
Styrene	4.04	ug/L	1.0	81	76	134	5.8	20	
1,1,1,2-Tetrachloroethane	5.04	ug/L	1.0	101	75	135	0	20	
1,1,2,2-Tetrachloroethane	5.48	ug/L	1.0	110	72	132	0.7	20	
Tetrachloroethene	14.3	ug/L	1.0	106	78	137	1.4	20	
Toluene	4.92	ug/L	1.0	98	78	134	3.2	20	
1,1,1-Trichloroethane	6.32	ug/L	1.0	99	64	141	3.1	20	
1,1,2-Trichloroethane	5.20	ug/L	1.0	104	72	133	1.6	20	
Trichloroethene	5.80	ug/L	1.0	98	75	138	1.4	20	
Trichlorofluoromethane	6.00	ug/L	1.0	109	58	139	1.3	20	
1,2,3-Trichloropropane	4.88	ug/L	1.0	98	67	133	0.8	20	
Vinyl acetate	4.92	ug/L	1.0	98	31	124	1.6	20	
Vinyl chloride	5.20	ug/L	1.0	104	66	140	0.8	20	
m+p-Xylenes	9.48	ug/L	1.0	95	78	133	2.1	20	
o-Xylene	4.92	ug/L	1.0	98	79	136	2.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Client: Richland County Health Dept

Project: Landfill #102

Report Date: 08/05/10

Work Order: B10072483

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW8260B									
Batch: R151480									
Sample ID: b10072483-006amsd	Sample Matrix Spike Duplicate			Run: SV5972.I_100729A			07/29/10 17:12		
Surr: 1,2-Dichloroethane-d4	103	70	130	1.0	103	70	130		
Surr: Dibromofluoromethane	106	77	126	1.0	106	77	126		
Surr: p-Bromofluorobenzene	108	76	127	1.0	108	76	127		
Surr: Toluene-d8	103	79	122	1.0	103	79	122		

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Workorder Receipt Checklist

Richland County Health Dept



B10072483

Login completed by: Darwin C. Miller

Date Received: 7/27/2010

Reviewed by: BL2000\kmcDonald

Received by: klb

Reviewed Date: 7/27/2010

Carrier name: Return-UPS
Ground

Shipping container/cooler in good condition?	Yes ☒	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☒	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☒
Chain of custody present?	Yes ☒	No ☐	
Chain of custody signed when relinquished and received?	Yes ☒	No ☐	
Chain of custody agrees with sample labels?	Yes ☒	No ☐	
Samples in proper container/bottle?	Yes ☒	No ☐	
Sample containers intact?	Yes ☒	No ☐	
Sufficient sample volume for indicated test?	Yes ☒	No ☐	
All samples received within holding time?	Yes ☒	No ☐	
Container/Temp Blank temperature:	12°C On Ice		
Water - VOA vials have zero headspace?	Yes ☒	No ☐	No VOA vials submitted ☐
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☒

Contact and Corrective Action Comments:

None



Chain of Custody and Analytical Request Record

Page ____ of ____

PLEASE PRINT (Provide as much information as possible.)

Company Name: Richland County			Project Name, PWS, Permit, Etc. landfill #102			Sample Origin State:		EPA/State Compliance: Yes ☐ No ☐				
Report Mail Address: 1201 West Holly Suite 5			Contact Name: Kelly Logan		Phone/Fax: 433-6876		Email:		Sampler: (Please Print)			
Invoice Address: Sidney MT 59270			Invoice Contact & Phone: KLOGAN@richland.org			Purchase Order:		Quote/Bottle Order:				
Special Report Formats: ☐ DW ☐ POTW/MWTP ☐ State: _____ ☐ Other: _____ ☐ EDD/EDT (Electronic Data) Format: _____ ☐ LEVEL IV ☐ NELAC			Number of Containers Sample Type: A W S V B O DW Air Water Solids/Solids Vegetation Bioassay Other DW - Drinking Water 9928 5.700A	ANALYSIS REQUESTED				SEE ATTACHED	Standard Turnaround (TAT) R U S H	Contact ELI prior to RUSH sample submittal for charges and scheduling - See Instruction Page Comments:	Shipped by: RTN UPS Ground	
											Receipt Temp 12 °C	
SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)			Collection Date	Collection Time	MATRIX	LABORATORY USE ONLY						
1 SL-3			7/25	1800	W	310072483-001 -002 -003 -004 -005 -006 -007 -008						
2 SL-4			7/25	1445	1							
3 SL-6			7/25	1300								
4 SL-7			7/24	1701								
5 SL-8			7-24	1754								
6 SL-9			7-24	1500								
7 TJUP			7/25									
8												
9 TB SHPO250			7-8-10	GC								
10												
Custody Record MUST be Signed	Relinquished by (print): Kelly Logan		Date/Time: 7/26/2010		Signature:		Received by (print): UPS		Date/Time:		Signature:	
	Relinquished by (print):		Date/Time:		Signature:		Received by (print):		Date/Time:		Signature:	
	Sample Disposal:		Return to Client:		Lab Disposal:		Received by Laboratory: APUS Buehler		Date/Time: 7-27-10		Signature: 09:00	

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested.

This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.

Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

RICHLAND COUNTY SANITARIAN

1201 West Holy Suite 5, Sidney, MT 59270

Phone: 406-433-6876

MEMORANDUM

TO: Martin Van Oort

FROM: Kelly Logan, R.S.

DATE: June 1, 2010

SUBJECT: additional monitoring wells at landfill #102

Enclosed is Tetra Tech proposal for additional monitoring wells at Richland County Landfill #102. We are currently writing a contract between the landowner and the Solid Waste Board to sign. No additional wells can be drilled in the alfalfa fields. The proposed well locations may have to be changed slightly when "locates" are done (pipelines in the area). If groundwater flow is to the NE, there is a small swale between the alfalfa fields that is a possible site that would be acceptable to the landowner.

Closed
County Richland
Facility & # Richland Co #102
Closure _____ Landfarm
Finan Assur _____ Liner
GW Corr Meas _____ Methane
GW Monitoring _____ O & M
GW Reports _____ Run-on
Inspections _____
Other: _____

RECEIVED

JUN 03 2010

DEPT. OF ENVIRO. QUALITY
WASTE & UNDERGROUND TANK
MANAGEMENT BUREAU



TETRA TECH

851 Bridger Dr. Ste. 6
Bozeman, MT 59715
Ph. 406-582-8780
Fax 406-582-8790
www.tetrattech.com

May 17, 2010

RECEIVED

JUN 03 2010

Mr. Kelly Logan and Mr. Russell Houtari
Richland County
2140 West Holly Street
Sidney, MT 59270

DEPT. OF ENVIRO. QUALITY
WASTE & UNDERGROUND TANK
MANAGEMENT BUREAU

**RE: Proposal for Additional Investigation and Monitoring Activities
Richland County Former Landfill #102
Sidney, Richland County, Montana**

Dear Gentlemen:

Tetra Tech is pleased to submit this work plan to conduct additional investigation and monitoring activities at the Richland County (former) Landfill #102. Specifically, the drilling and installation of up to five monitoring wells are proposed to evaluate the downgradient extent (with respect to groundwater) of tetrachloroethene (also referred to as PCE) in the northern part of the site (**Figure 1**). This work plan outlines our proposed scope of work, estimated cost, and schedule for completion of this aspect of the project.

PROJECT BACKGROUND

Project background is provided in Tetra Tech's *Report of Investigation and Monitoring Activities – November and December 2009*¹. This report was submitted to Richland County on May 14, 2010. Four additional monitoring wells, SL-6 through SL-9 were drilled and completed north of the north landfill boundary in November 2009 in an effort to define the extent of PCE-impacted groundwater. The investigation determined a northerly groundwater gradient and flow. All of the wells SL-6 through SL-9 were impacted with PCE in concentrations exceeding the Montana Department of Environmental Quality (DEQ) human health standard². The size of the area of PCE-impacted groundwater was not anticipated and therefore, the northern extent of PCE-impacted groundwater was not determined in the November 2009 investigation.

SCOPE OF SERVICES

Our proposed scope of services is presented in five tasks. These will include the following:

Project Management

This task consists of proposal preparation, communications with potential subcontractors (drilling services), obtaining the drilling services, and project scheduling and implementation. Tetra Tech will assist Richland County in developing the well specifications and obtaining bids from drilling contractors for this project, however, the drilling contractor will contract directly with Richland County.

Site Clearance, Orientation, and Clearance of Underground Utilities

This task consists of obtaining landowner permission(s) to conduct drilling/well completion activities, locating each of the proposed drill holes in the field, and conducting clearances of potential underground utilities at each of the proposed drill hole locations. It is anticipated that most of these activities will be conducted by Richland County personnel.

Richland County personnel familiar with the location of underground utilities in the area of the proposed drilling will be contacted. In addition, Tetra Tech can provide a site map of proposed drill hole locations to the *Underground Utility Notification Center* to confirm the absence of any underground utilities in the vicinity of the drill hole locations.

Field Investigation

The field investigation task will be focused on the determination of the extent of PCE-impacted groundwater, in the glacial till formation, north of the landfill. This task consists of supervision and implementation of drilling and completion of up to five groundwater monitoring wells in the perceived downgradient (with respect to groundwater flow) direction. The approximate location of these wells is shown in **Figure 1**. Details are provided below:

- Richland County is collecting depth to groundwater measurements on a monthly basis. Prior to the drilling and installation of the proposed wells, these data will be used to calculate groundwater flow directions and confirm the proposed monitoring well locations.
- The proposed drilling is intended to intersect the top of the Fort Union Formation, like all of the previous drilling. The hollowstem auger drilling technique appears suitable based on information from the drilling of wells SL-6 through SL-9, decreasing ground surface elevations north of well SL-7 (Figure 1), well SL-7's intersection of the Fort Union at 74 feet¹, and the sandy nature of the glacial till. In addition, this drilling technique can return high quality soil samples and is more economical than air rotary drilling.
- Tetra Tech personnel will supervise the drilling of the monitoring wells to log the soil/geologic materials during drilling; note any changes in lithology, drilling rate, water, and other conditions; and confirm the intersection with the Fort Union Formation. It is expected that Tetra Tech personnel will travel to Sidney from the Billings office and remain at the site near Sidney until the drilling and well installation is completed.
- Wells will be constructed of 2-inch diameter schedule 40 PVC with 0.020-inch slots in screened sections. In addition to providing the PVC piping, the driller will install:
 - 10-20 silica sand to two feet above top of slotted casing,
 - bentonite seal from top of sand pack to within 2 feet of grade,
 - stickup and locking well protector set in concrete grout,
 - the stickup steel will be painted high-visibility orange, and
 - care will be taken during protector installation to ensure they are not susceptible to frost-heaving.

- Wells will be installed in phases with two or three wells in each phase to ensure the most accurate placement of the furthest downgradient wells. The objective of this well installation program is to define the downgradient extent and width of the PCE-impacted groundwater. Richland County personnel will survey the elevation of the top of casing of the first two or three new wells and Tetra Tech personnel will measure groundwater levels the morning of the second or third day of the drilling program. This data will be used to estimate the direction of groundwater flow using the newest monitoring wells and, therefore, guide the drilling/installation of the remaining two or three monitoring wells.
- Upon completion, wells will be developed to remove fine sediment. Development water will not be containerized.
- Following completion of the five monitoring wells, surveying will be conducted by Richland County personnel to determine the top of casing elevation above mean sea level (AMSL) for each of the new wells.
- The new wells will be included in the next groundwater monitoring program conducted by Richland County. Given the sole purpose of these wells to aid in the determination of the downgradient extent of PCE-impacted groundwater, samples will be collected only for analysis of volatile organic compounds (VOCs) in accordance with United States Environmental Protection Agency Method SW-8260B.

Data Analysis and Report Preparation

Data analysis will be conducted following the receipt of all data to include: drilling and well completion, surveying, well lithology logs, well completion logs, and development logs. The results of this investigation and data analysis will be summarized in a report prepared for Richland County. This report will also contain conclusions and recommendations for additional work, as deemed appropriate.

Budget

A schedule of estimated fees to complete the above described work is contained in **Attachment A**. Total estimated cost for this phase of the project is approximately \$14,817. The drilling contractor costs are not included in this total, since they will be contracted directly with Richland County. Our estimated costs are based on preliminary estimates of the drilling rate and well completion time for hollow stem auger drilling on the site. All tasks will be completed on a time and materials basis.

Schedule

Tetra Tech will proceed with the above described activities in accordance with this work plan upon receiving authorization from Richland County and the Department of Environmental Quality (DEQ). Field activities will be scheduled for May or June 2010 depending on approvals and drill rig availability. The report will be completed and submitted to Richland County within 30 days of receipt of all laboratory data.

May 17, 2010

Acceptance

To engage Tetra Tech to perform the above mentioned scope of services, please sign and return one copy of the enclosed Agreement for Professional Consulting Services. This proposal for services and the Professional Services Agreement shall constitute the entire agreement between parties.

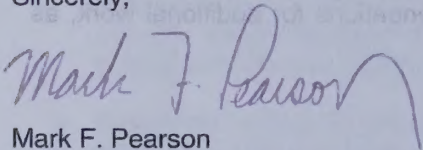
Limitations

Tetra Tech will conduct the proposed investigation in a manner that is reflective of current investigation methods for the type of site conditions encountered. It should be understood that the implementation of this work plan may not necessarily determine the total downgradient extent of PCE-impacted groundwater that appears to be flowing northward from the landfill. In addition, this proposed investigation is only to assess PCE-impacted groundwater within the glacial till deposits. No provision has been made in this work plan to investigate the occurrence of this type of contamination to groundwater in the Fort Union Formation underlying the glacial till deposits.

We look forward to working with you on this project. If you have any questions regarding this work plan, cost estimate, and/or agreement, please call Mark Pearson at office (406) 582-8780, cell (406) 459-4169 or email Mark Pearson at mark.f.pearson@tetrattech.com.

Following any edits to this document and approval from you, we can forward this to Martin VanOort, case manager, Montana Department of Environmental Quality. We appreciate the opportunity to work with Richland County on this project.

Sincerely,



Mark F. Pearson
Project Hydrogeologist

mfp

Enclosures:

Figure 1 – Site Vicinity Map
Attachment A: Estimated Costs
Attachment B: Consulting Services Agreement

Endnote:

- 1 Tetra Tech 2010. *Report of Investigation and Monitoring Activities – November and December 2009*. Report submitted to Richland County May 14.
- 2 Montana DEQ 2008. Circular DEQ-7 Montana Numeric Water Quality Standards. February.



5.7 / 7.9 Tetrachloroethene / Total Chlorinated Solvents
(Concentrations in micrograms per liter,
December 2009 Monitoring Results)

ND Not Detected
(December 2009 Monitoring Results)

Total Chlorinated Solvents List
Chloroform (Trichloromethane)
1,1 Dichloroethane
cis 1,2 Dichloroethane
Tetrachloroethene
1,1,1 Trichloroethane
Trichloroethene
Dichlorodifluoromethane (Freon-11)



Legend

- Landfill Boundary
- Cultivated Field
- Spring
- Monitoring Well
- Bumpit
- Waste Area Deep
- Waste Area Shallow
- Elevation Contour (feet)

- Calculated Groundwater Flow Direction (December 2009)
- Proposed Monitoring Well

(Source: USGS 1/3-Arc Second National Elevation Dataset.
Does not correspond to surveyed well elevations.)

April 21, 2010

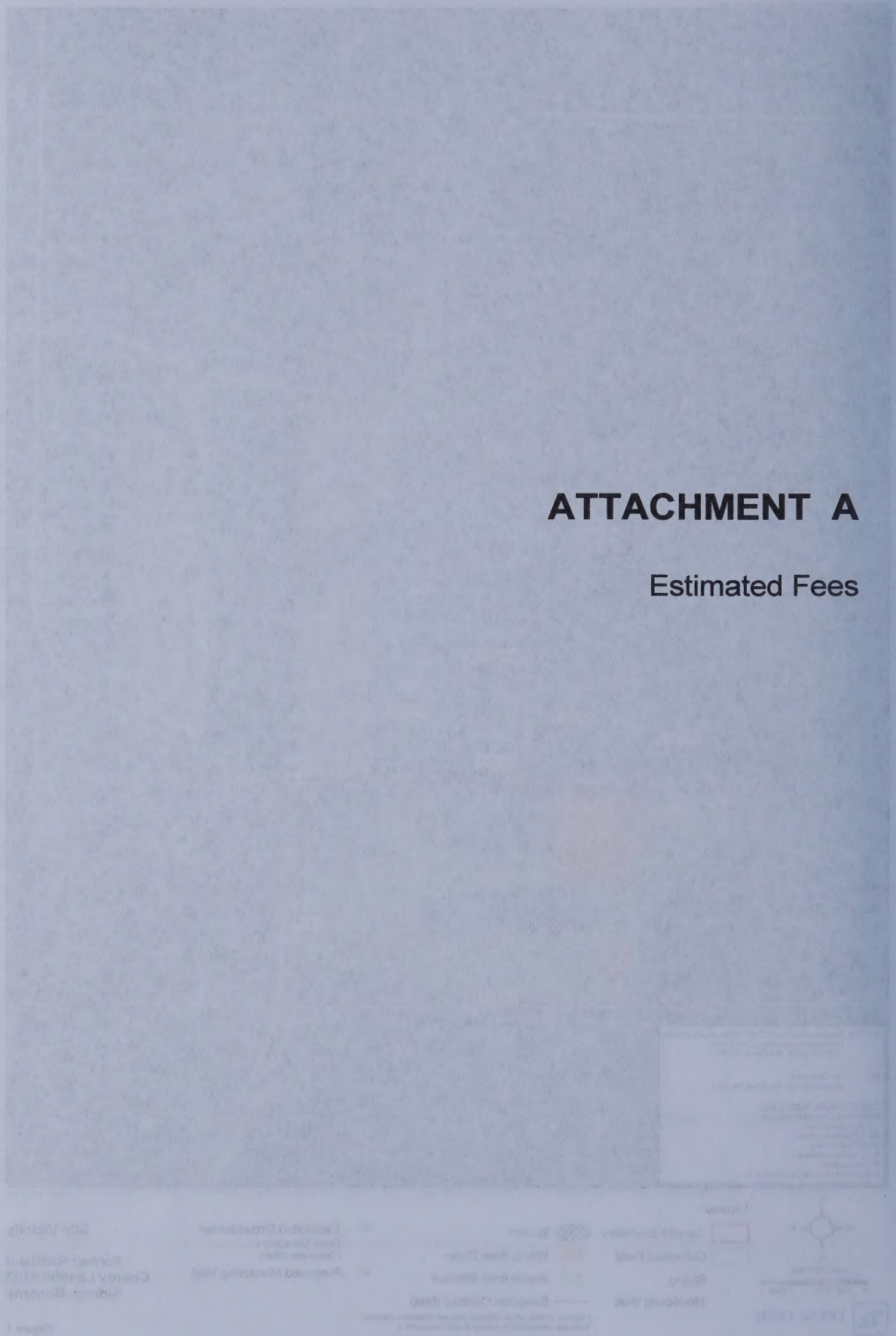
Site Vicinity
Former Richland
County Landfill #102
Sidney, Montana



Figure 1

ATTACHMENT A

Estimated Fees





MAILED

10/10/18
mfm

September 28, 2018

Mr. Adam Smith
2140 W Holly St
Sidney, MT 59270-5700

**RE: CLOSED RICHLAND COUNTY LANDFILL – LICENSE #102
JUNE 2018 GROUNDWATER MONITORING REPORT REVIEW**

Dear Mr. Smith:

The report has been reviewed and meets the requirements of the Administrative Rules of Montana Title 17, Chapter 50, Subchapter 13.

The facility remains in corrective action with semi-annual monitoring. If you have any questions please contact me.

Sincerely,

John Collins
Hydrogeologist
Solid Waste Program
Phone: 406-444-2802, Fax: 406-444-1374
E-mail: jcollins3@mt.gov

cc: Mr. Josh Johnson, Richland County, 1201 W Holly St. Ste 5, Sidney, MT 59270

MAILER
1961





Montana Department of
ENVIRONMENTAL QUALITY

MEMO

TO: Solid Waste Files
Closed\Richland Co.\Richland County Landfill\Lic. #102\Groundwater Reports

FROM: Martin Van Oort, Hydrogeologist – Solid Waste Section

DATE: May 2, 2013

SUBJECT: **Summary of Groundwater Monitoring at the closed Richland County Landfill, License #102**

Groundwater monitoring at the closed Richland County Landfill began in 1990. Samples for VOCs were first collected in 1991 and showed contamination of groundwater by chlorinated solvents and CFCs. Tetrachloroethene is the primary contaminant and has exceeded groundwater protection standards since the initiation of monitoring.

The primary source of contamination is the deep cells area, where two trenches were excavated to depths of 25-40 feet. There is also a source of VOCs which impacts groundwater at the eastern edge of the facility at lower concentrations. Closure of the landfill began in 1995 and was completed in 1997. In 2001 corrective measures of passive gas venting were implemented in the deep cells area.

To better define the extent of the off-site plume, additional wells north of the facility were installed in 2009 and 2010. Because of the continued exceedances at and beyond the RPOC a revised corrective measures assessment was completed in 2012 and active gas extraction and in-situ groundwater treatment were approved as additional corrective measures.

A point of contention with Richland Co. throughout my tenure has been whether the contamination results from gas or leachate migration from the source. From the available data, my conclusion has been that there is at least some component of leachate migration from the source, and it is most likely the dominant component.

Work on implementing pilot tests for the new corrective measures began in April 2013 with additional site characterization including groundwater wells along the north boundary of the deep cells area and gas and leachate sampling wells within the deep cells waste prism. The results of this initial stage should be forthcoming soon, as Richland Co. wants to move forward with additional tasks to implement the pilot tests beginning in June 2013.

These new corrective measures do not initially address the contamination already off-site, rather relying on monitored natural attenuation to reduce contaminant concentrations. The in-situ treatment could be expanded off-site in the future if natural attenuation does not prove effective.

MEMO

ENVIRONMENTAL QUALITY

THE UNIVERSITY OF

DATE: 10/10/1991

TO: Mr. J. J. O'Connell, County Council, 100, O'Connell Street, Dublin 1

FROM: Mr. J. J. O'Connell, County Council, 100, O'Connell Street, Dublin 1

SUBJECT: 100, O'Connell Street, Dublin 1

RE: 100, O'Connell Street, Dublin 1

The following information is being provided to you in response to your request for information under the Freedom of Information Act 1997. The information is being provided to you in accordance with the provisions of the Act. The information is being provided to you in accordance with the provisions of the Act. The information is being provided to you in accordance with the provisions of the Act.

The following information is being provided to you in response to your request for information under the Freedom of Information Act 1997. The information is being provided to you in accordance with the provisions of the Act. The information is being provided to you in accordance with the provisions of the Act. The information is being provided to you in accordance with the provisions of the Act.

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61052-1

County Richland

Facility & # Richland Co #102

Closure Landfarm

Finan Assur Liner

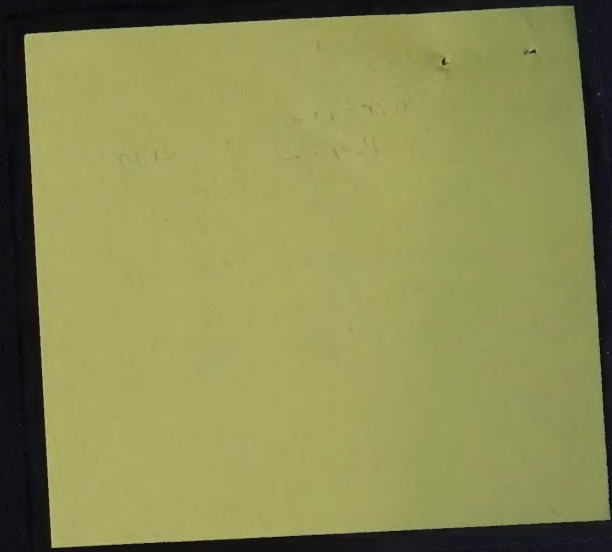
GW Corr Meas Methane

GW Monitoring O & M

GW Reports Run-on

Inspections

Other: _____



RECEIVED

FEB 13 2009

DISTRICT SANITARIAN
Richland and McCone County Health Departments

DEPT. OF ENVIRO. QUALITY
WASTE & UNDERGROUND TANK
MANAGEMENT BUREAU

1201 West Holy Suite 5

Sidney, MT 59270

Phone: 406-433-6876

MEMORANDUM

TO: Martin Van Oort

FROM: Kelly Logan, R.S.

DATE: February 11, 2009

SUBJECT: **sampling plan** and methane system

The sampling plan for the Sidney Landfill is enclosed. The sampling plan for the Richland County Landfill will be basically the same with only minor changes and will be mailed to you after receiving your comments on the SAP submitted. Trying to keep things simple for me and make the necessary changes only once. To address the methane issue at the Sidney landfill we are considering adding six additional trenches fifty feet apart. The trenches would be constructed as previously approved (shown on the enclosed diagram). This assumes that each trench has 50 feet of influence. We are working with a consultant to determine if there are other cost effective options available.

FLJ

Closed

County Richland

Facility & # Richland Co #102

Closure Landfarm

Finan Assur Liner

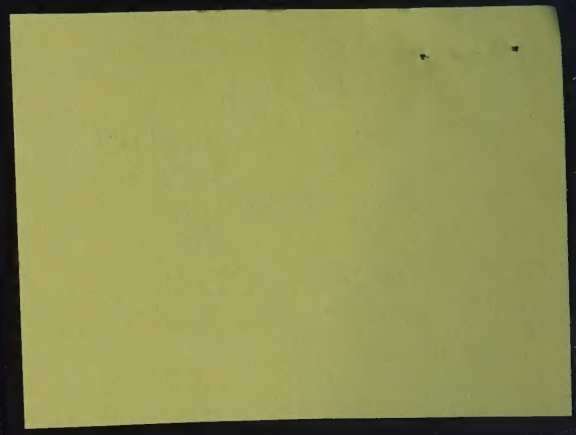
GW Corr Meas Methane

GW Monitoring O & M

GW Reports Run-on

Inspections

Other: _____



RICHLAND COUNTY SANITARIAN

1201 West Holy Suite 5, Sidney, MT 59270

Phone: 406-433-6876

MEMORANDUM

TO: Martin Van Oort, Solid Waste Program

FROM: Kelly Logan, R.S.

DATE: May 9, 2011

SUBJECT: Amendment to Sampling & Analysis Plan

The Richland County Solid Waste District is requesting a revision to the Sampling & Analysis Plan for Landfill #102 dated December 3, 2010. Lamphier's well was included in the monitoring schedule to be sampled for field parameters (pH and specific conductance) to provide some continuity to the data. However Lamphiers have filed a lawsuit against the Solid Waste District and the County Health Department and to avoid any conflicts and for personal safety the well will not be sampled. No VOCs have been detected in this well after sixteen years of monitoring and the health risk is considered negligible.

Kelly Logan

15
RECEIVED

MAY 13 2011

DEPT. OF ENVIRO. QUALITY
WASTE & UNDERGROUND TANK
MANAGEMENT BUREAU

Amendment to Sampling and Analysis Plan
For Sidney Landfill #102

(Dated December 3, 2010)

April '18, 201

RECEIVED

MAY 13 2011

DEPT. OF ENVIRO. QUALITY
WASTE & UNDERGROUND TANK
MANAGEMENT BUREAU

To clarify the samples to be collected and the sites to be monitored per DEQ letters dated November 23, 2010 and February 1, 2011.

Sampling site	Collected in spring and fall	Collected in spring only
S-5, SL-1 thru SL-13	VOC's; field parameters	
S-5, SL-1 thru SL-4	inorganics	
SL-1 thru SL-4		Barium, selenium
Almond's spring	Field parameters	

The parameters to be collected are:

- Barium (spring only)
- Chloride
- Nitrate + nitrite
- Selenium (spring only)
- Sulfate
- pH
- Specific conductance
- 40 CFR Part 258
Appendix I VOCs
+ dichlorodifluoromethane

Water elevations will be measured in wells SL-1 thru SL-15.

Amendment to Standing and Analysis for
For Study (Amendment 10)

(Date: December 1, 2011)

Page 12 of 12

For the purpose of this study, the following information was collected and analyzed:

Category	Item	Value
Category 1	Item 1	Value 1
Category 1	Item 2	Value 2
Category 1	Item 3	Value 3
Category 1	Item 4	Value 4
Category 1	Item 5	Value 5
Category 1	Item 6	Value 6
Category 1	Item 7	Value 7
Category 1	Item 8	Value 8
Category 1	Item 9	Value 9
Category 1	Item 10	Value 10
Category 1	Item 11	Value 11
Category 1	Item 12	Value 12
Category 1	Item 13	Value 13
Category 1	Item 14	Value 14
Category 1	Item 15	Value 15
Category 1	Item 16	Value 16
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Category 1	Item 96	Value 96
Category 1	Item 97	Value 97
Category 1	Item 98	Value 98
Category 1	Item 99	Value 99
Category 1	Item 100	Value 100

The following information was collected:

- Item 1
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- Item 95
- Item 96
- Item 97
- Item 98
- Item 99
- Item 100

The following information was collected:

• Closed

County Richland

Facility & # Rockland G #102

Closure Landfarm

Finan Assur Liner

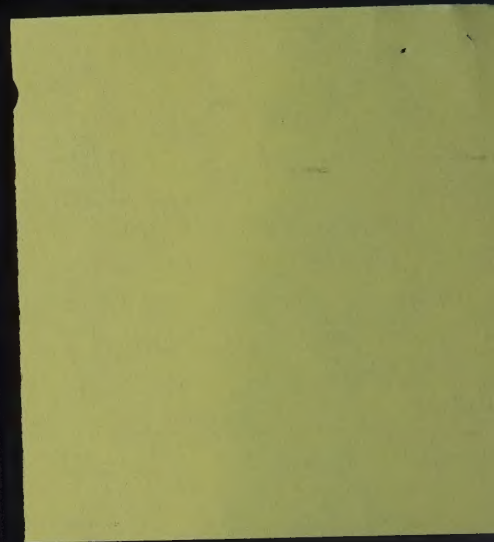
GW Corr Meas Methane

GW Monitoring O & M

GW Reports Run-on

Inspections

Other: _____





TETRA TECH, INC.

851 Bridger Drive, Suite F
Bozeman, MT 59715

Telephone: (406) 582-8780
Fax: (406) 582-8790

TRANSMITTAL

TO	Martin Van Oort
FROM	Mark Pearson <i>Mark F. Pearson</i>
cc	
DATE	4/2/2010

Please find the information enclosed:

- ☐ complete
☐ partial
☐ draft

- ☐ urgent
☐ confidential
☒ for your review

Sent:

- ☒ US mail
☐ UPS
☐ E-mail
☐ Hand delivered

- ☐ Priority US mail
☐ FedEx
☐ Fax
☐ Other _____

COMMENTS:

Please find enclosed drill logs for Richland County Landfill.

fl
RECEIVED

APR 06 2010

Dept. of Enviro. Quality
Waste & Underground
Tank Management Bureau



УЧЕБНО-МЕТОДИЧЕСКОЕ ПОСОБИЕ

по предмету «Математика»

для учащихся 5 класса

автор: [Имя Фамилия]

рецензент: [Имя Фамилия]

издание: [Число]

г. [Город]

20[Число]

стр. [Число]

изд. [Число]

тираж [Число]

подписано в печать [Число]

факт [Число]

заказ [Число]

исполнение [Число]

срок [Число]

стоимость [Число]

артикул [Число]

серия [Число]

группа [Число]

класс [Число]

участники [Число]

содержание [Число]

введение [Число]

часть 1 [Число]

часть 2 [Число]

часть 3 [Число]

PROJECT: NUMBER: 114-56-33
NAME: Richland County Landfill
(old landfill)

MONITORING SL-6 / BORING NO. SL-6
SHEET 1 OF 2
LOCATION: _____

DRILL TYPE: SOIL: AIR ROTARY w/ Casing Hammer

ROCK: _____

DRILLED BY: H&H Drilling - Glendive

LOGGED BY: PAUL LEMIRE

REMARKS: _____

ELEVATION: TOP OF HOLE: _____

(ft) GROUNDWATER: 77.3 ft

DATE: STARTED: 11/9/09 COMPLETED: 11/10/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS				
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING	
0.0		0-1 TOP SOIL; Gravel, sand, clay and silt; moist; brown	Continuous Sampling of Cuttings				None	None	
5.0		1-13 GRAVEL; small size; sand; silt; some clay; dry; brown							
10.0		13-30 SAND; fine to med. grain; poorly sorted; brown; loose; moist							
15.0		30-40 SAND; w/ some small shale pieces; loose; poorly sorted; brown; moist							
20.0		40-50 Silty SAND w/ some clay; moist; brown							
25.0		50-60 SAND; w/ some silt; fine to med. grain; moist; loose; brown							
30.0		60-65 GRAVEL w/ sand; fine-grained sand; moist; granitic gravel							

RECEIVED
APR 06 2010
Dept. of Enviro. Quality

RECEIVED

APR 06 2010

Dept. of Enviro. Quality
Waste & Underground
Tank Management Bureau

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK / BAG SAMPLE

COR = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
-- = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN

DEPTH TO BOTTOM OF BORING
85 FT

TETRA TECH

MONITORING WELL NO. SL-6
SHEET 1 OF 1
LOCATION: _____

DRILL TYPE: SOIL: _____
ROCK: _____
DRILLED BY: _____
LOGGED BY: _____
REMARKS: _____

DATE: HOLE STARTED: 11/9/09
COMPLETED: 11/10/09

Bottom of Boring

Depth to Bottom of Boring 85 ft

NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.



TETRA TECH

PROJECT: NUMBER: 114-500133
NAME: Richland County Landfill
(OLD LANDFILL)

MONITORING WELL/BORING NO. SL-6

SHEET 2 OF 2

LOCATION: _____

DRILL TYPE: SOIL: Air Rotary w/casing hammer

ROCK: _____

DRILLED BY: H & H DRILLING

LOGGED BY: PAUL LEMURE

REMARKS: _____

ELEVATION: TOP OF HOLE: _____

(ft) GROUNDWATER: 77.3 ft

DATE: STARTED: 11/9/09 COMPLETED: 11/10/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
30.0		65-67 SAND w/ some gravel; moist; brown	Continuous Sample of Cuttings				None	None
35.0		67-75 GRAVEL w/ sand; small to med gravel; brown; moist						
40.0		75-80 SAND; fine to med grain; poorly sorted; brown moist						
45.0		80-84 GRAVEL w/ sand; well sorted; small gravel; quartz rocks in gravel; wet						
50.0		84-85 SHALE; gray; moist						
55.0								
60.0								

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK /BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
-- = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN
-- =

DEPTH TO BOTTOM OF BORING
85 ft

Tt TETRA TECH

PROJECT: NUMBER: 164-S-133
NAME: Richland County Landfill
(old Landfill)

MONITORING SL-7
SHEET 1 OF 2
LOCATION: _____

DRILL TYPE: SOIL: AIR ROTARY w/ casing hammer
ROCK: _____
DRILLED BY: H & H Drilling - Glendive
LOGGED BY: Paul Lemire
REMARKS: _____

ELEVATION: TOP OF HOLE: _____
(ft) GROUNDWATER: 63.80 ft
DATE: STARTED: 11/11/09 COMPLETED: 11/12/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
0.0		0-1 Topsoil; sand, silt and clay; dry	Continuous Sample of Cuttings				None	None
5.0		1-15 CLAY, sandy w/ silt; brown; dry						
10.0		15-30 CLAY w/ sand and rock (shale) chips; occasional quartz rock chips; dry to moist						
15.0		30-35 CLAY w/ sand and gravel; small gravel; moist						
20.0		35-43 SAND; med size grain; well sorted; loose; moist						
25.0		43-47 GRAVEL; small size; w/ sand; loose; moist						
30.0		47-55 GRAVEL; small to med. size; coarse-grain sand; well sorted						

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK / BAG SAMPLE
CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
-- = NOT ANALYZED
NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN
-- =

DEPTH TO BOTTOM OF BORING
74 FT



PROJECT: NUMBER: 114-560133
NAME: Richland County
(OLD LANDFILL)

MONITORING WELL NO. SL-7
SHEET 1 OF 1
LOCATION: _____

DRILL TYPE: SOIL: AIR ROTARY w/ Casing Hammer
ROCK: _____
DRILLED BY: H&H Drilling - Glendive
LOGGED BY: PAUL LEMIRE
REMARKS: _____

DATE: HOLE STARTED: 11/11/09
COMPLETED: 11/12/09

ELEVATIONS

Top of Protective Casing

Top of PVC Casing

Top of Ground Surface

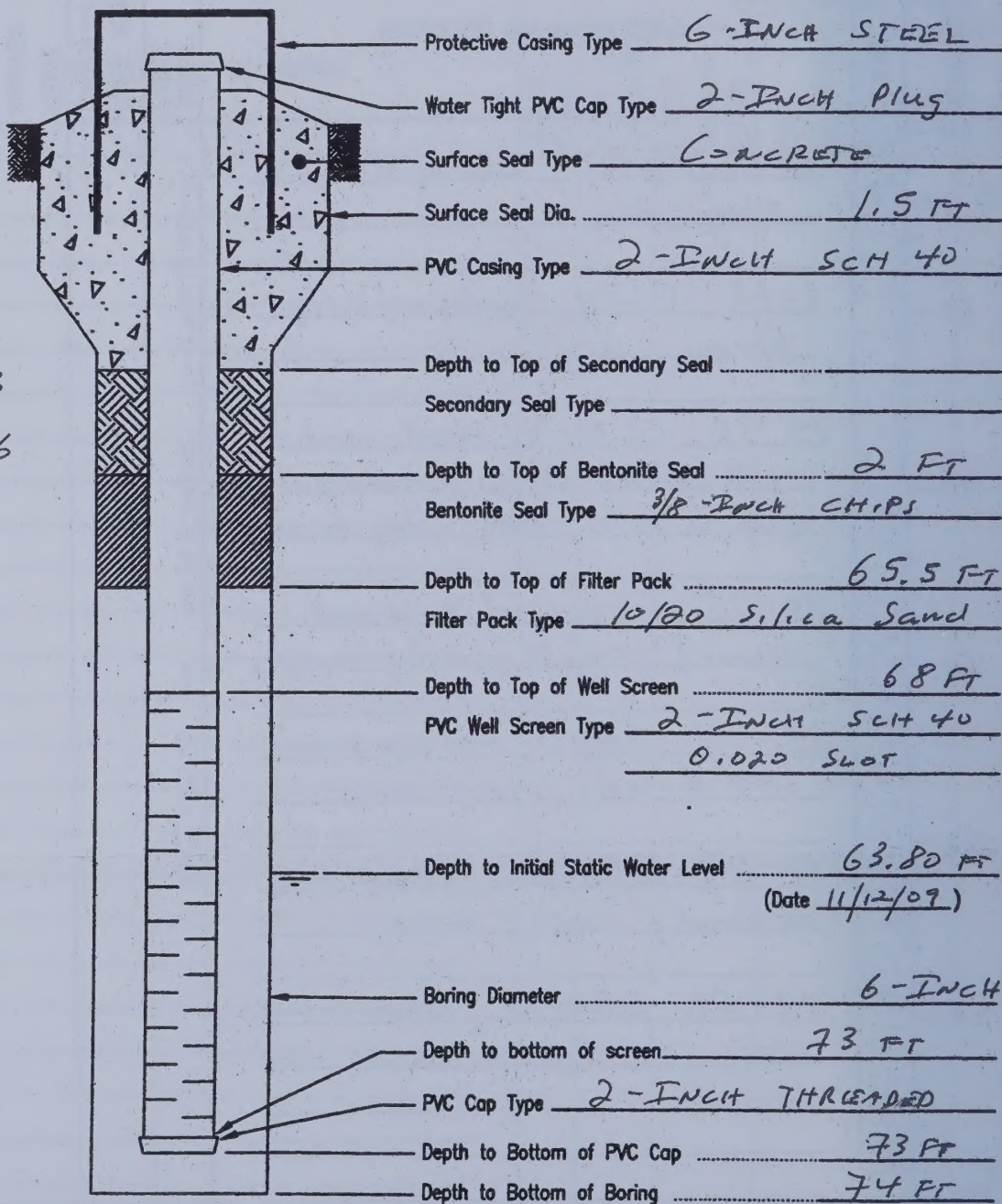
N 47.76743

E -104.17336

Groundwater

Bottom of Well Screen

Bottom of Boring



NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: 114-560133
NAME: Richland County Landfill
(old land fill)

MONITORING WELL/BORING NO. SL-7

SHEET 2 OF 2

LOCATION: _____

DRILL TYPE: SOIL: Air Rotary w/casing hammer

ROCK: _____

DRILLED BY: H & H Drilling - Glendive

LOGGED BY: Paul Lemire

REMARKS: _____

ELEVATION: TOP OF HOLE: _____
(ft) GROUNDWATER: 63.80 Ft

DATE: STARTED: 11/11/09 COMPLETED: 11/12/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
30.0		55-73 GRAVEL w/ sand; small to med size gravel; med to coarse sand; brown; moist; loose	Continuous Samples of CUTTINGS				None	None
35.0		73-74 SHALE; gray; moist						
40.0								
45.0								
50.0								
55.0								
60.0								

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK
/BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR
CHEMICAL ANALYSIS
-- = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN
-- =

DEPTH TO BOTTOM OF BORING

74 FT



TETRA TECH

PROJECT: NUMBER: 114-5633
NAME: Richland County Landfill
(old landfill)

MONITORING 2/BORING NO. 5L-8
SHEET 1 OF 2
LOCATION: _____

DRILL TYPE: SOIL: Air Rotary of Casing Hammer

ROCK: _____

DRILLED BY: H & H DRILLING - Glendive

LOGGED BY: PAUL LEMIRE

REMARKS: _____

ELEVATION: TOP OF HOLE: _____

(ft) GROUNDWATER: 56.02 ft

DATE: STARTED: 4/12/09 COMPLETED: 4/13/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS				
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING	
0.0		0-1 TOPSOIL ; sand, silt and gravel; dry	Continuous Sampling of Cuttings				None	None	
5.0		1-5 SAND w/ small gravel; med grain sand; loose; brown; moist							
10.0		5-30 SAND; loose; poorly sorted; med grain size; brown; moist							
15.0		30-38 SAND w/ small gravel; med. grain sand; loose; moist							
20.0		38-42 CLAY; brown; moist; occasional gravel							
25.0		42-56 GRAVEL w/ sand; small to med. gravel; coarse sand; loose; moist to wet							
30.0		56-57 SHALE; gray; moist							

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK /BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
"- " = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN
"- " =

DEPTH TO BOTTOM OF BORING
57. FT



TETRA TECH

PROJECT NUMBER: 114-560133
 NAME: Richland County Landfill
(old landfill)
 DRILL TYPE: SOIL: AIR ROTARY w/ Casing Hammer
 ROCK: _____
 DRILLED BY: H & H Drilling
 LOGGED BY: Paul Lemire
 REMARKS: _____

MONITORING WELL NO. SL-8
 SHEET 1 OF 1
 LOCATION: _____

DATE: HOLE STARTED: 11/11/08
 COMPLETED: 11/12/09

ELEVATIONS

Top of Protective Casing
2176
 Top of PVC Casing

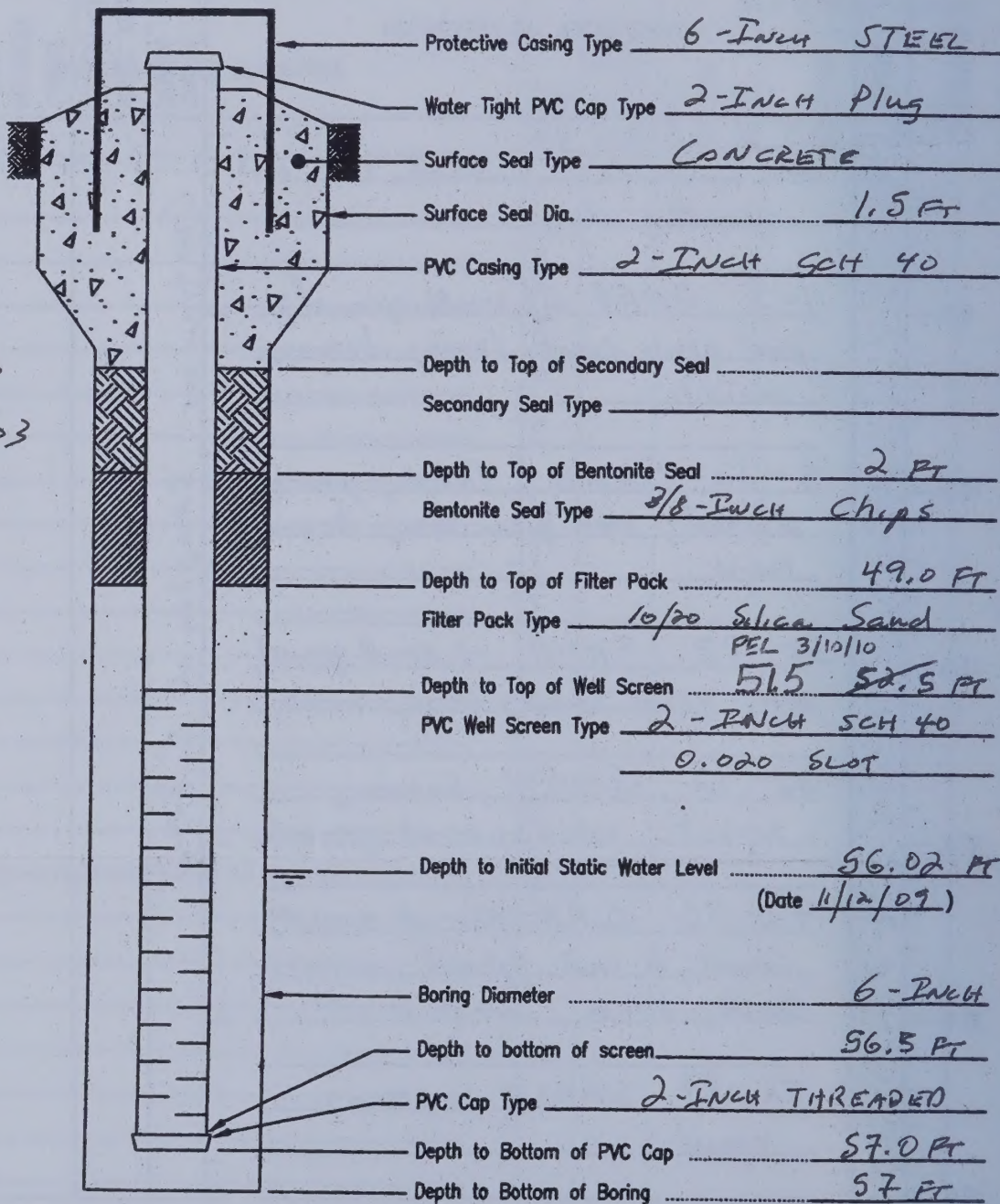
 Top of Ground Surface
2193

N 47.76656
 E - 104.17503

Groundwater

Bottom of Well Screen

Bottom of Boring



NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: 114-560 133
 NAME: Richland County Landfill
(old landfill)
 DRILL TYPE: SOIL: Air Rotary
 ROCK: _____
 DRILLED BY: H & H Drilling
 LOGGED BY: Paul Lemire
 REMARKS: _____

MONITORING WELL/BORING NO. SL-8
 SHEET 2 OF 2
 LOCATION: _____

ELEVATION: TOP OF HOLE: _____
 (ft) GROUNDWATER: 56.02 ft
 DATE: STARTED: 4/12/09 COMPLETED: 4/13/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS					
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING		
30.0			CONTINUOUS SAMPLES OF CUTTINGS				NONE	NONE		
35.0										
40.0										
45.0										
50.0										
55.0										
60.0										

CAL = CALIFORNIA
 SS = SPLIT SPOON
 ST = SHELBY TUBE
 DB = DISTURBED BULK /BAG SAMPLE

CON = CONTINUOUS SAMPLE
 CORE = CORE SAMPLE
 CA = SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS
 "-" = NOT ANALYZED

NS = NO SHEEN
 SS = SLIGHT SHEEN
 MS = MODERATE SHEEN
 HS = HEAVY SHEEN

DEPTH TO BOTTOM OF BORING

DATE: _____ STARTED: _____ COMPLETED: _____

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
60.0								
65.0								
70.0								
75.0								
80.0								
85.0								
90.0								

TETRA TECH

PROJECT: NUMBER: 114-S-133
NAME: Richland County Landfill

MONITORING SL-9 / BORING NO. SL-9
SHEET 1 OF 2
LOCATION: _____

DRILL TYPE: SOIL: Air Rotary w/ Casing Hammer
ROCK: _____
DRILLED BY: H & H Drilling - Glendive
LOGGED BY: PAUL LEMIRE
REMARKS: _____

ELEVATION: TOP OF HOLE: _____
(ft) GROUNDWATER: 39.62 FT
DATE: STARTED: 11/13/09 COMPLETED: 11/13/09

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
0.0		0-2 Topsoil; sand, silt clay and gravel; moist	Continuous Sampling & Cuttings				NONE	NONE
5.0		2-10 SAND; med to coarse grain; poorly sorted; brown moist						
10.0		10-15 CLAY; soft; brown; some silt; moist						
15.0		15-20 SAND; med to coarse grain; brown; poorly sorted; moist						
20.0		20-30 SAND w/ gravel; poorly sorted; med. gravel; brown; moist						
25.0		30-35 GRAVEL w/ sand; med gravel; brown; moist						
30.0		35-40 GRAVEL w/ sand; small to med gravel; brown; moist						

CAL = CALIFORNIA CON = CONTINUOUS SAMPLE NS = NO SHEEN
SS = SPLIT SPOON CORE = CORE SAMPLE SS = SLIGHT SHEEN
ST = SHELBY TUBE CA = SAMPLE SUBMITTED FOR MS = MODERATE SHEEN
DB = DISTURBED BULK CHEMICAL ANALYSIS HS = HEAVY SHEEN
/BAG SAMPLE "-" = NOT ANALYZED

DEPTH TO BOTTOM OF BORING
46 FT



PROJECT: NUMBER: 114-560133
NAME: RICHMOND COUNTY LANDFILL
(Old landfill)

MONITORING WELL NO. SL-9
SHEET 1 OF 1
LOCATION: _____

DRILL TYPE: SOIL: AIR ROTARY w/ Casing Hammer
ROCK: _____
DRILLED BY: H & H Drilling
LOGGED BY: Paul Lemire
REMARKS: _____

DATE: HOLE STARTED: 11/13/09
COMPLETED: 11/13/09

ELEVATIONS

Top of Protective Casing

Top of PVC Casing

Top of Ground Surface

2178

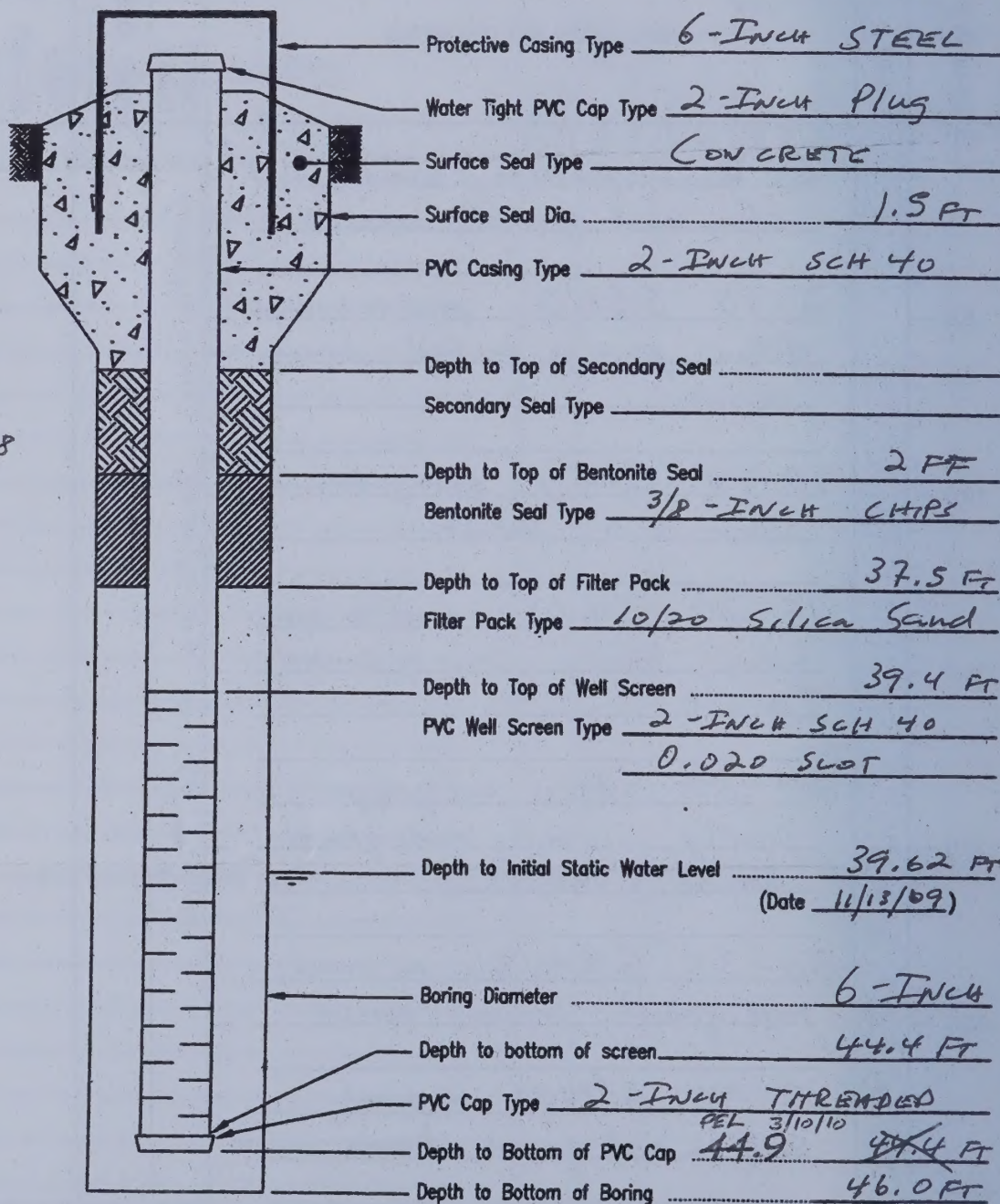
N 47.76625

E -104.17768

Groundwater

Bottom of Well Screen

Bottom of Boring



NOT TO SCALE

NOTE: ALL DEPTHS ARE TO BE REFERENCED FROM GROUND SURFACE.

PROJECT: NUMBER: 114-560133
NAME: Richland County Landfill
old landfill

MONITORING WELL/BORING NO. SL-9

SHEET 2 OF 2

LOCATION: _____

DRILL TYPE: SOIL: AIR ROTARY w/ Casing Hammer

ROCK: _____

DRILLED BY: H & H DRILLING

LOGGED BY: PAUL LEMIRE

REMARKS: _____

ELEVATION: TOP OF HOLE: _____

(ft) GROUNDWATER: 39.62 FT

DATE: STARTED: 11/13/07 COMPLETED: 11/13/07

DEPTH (ft.)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	PENET. RESIST. (BLOWS/ft.)	FIELD SCREENING RESULTS			
					SAMPLE RECOVERY LENGTH	PID HEADSPACE	ODOR	STAINING
30.0		40-45 GRAVEL w/sand; med to small gravel; well sorted sand; brown; moist	Continuous Sample or Cuttings				NONE	NONE
35.0								
40.0								
45.0								
50.0								
55.0								
60.0								

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK
/BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR
CHEMICAL ANALYSIS
"- " = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN
"- " =

DEPTH TO BOTTOM OF BORING

46 FT



TETRA TECH

REMARKS:

LOCATION: _____

DATE: _____ STARTED: _____ COMPLETED: _____

[illegible]

CAL = CALIFORNIA
SS = SPLIT SPOON
ST = SHELBY TUBE
DB = DISTURBED BULK
/BAG SAMPLE

CON = CONTINUOUS SAMPLE
CORE = CORE SAMPLE
CA = SAMPLE SUBMITTED FOR
CHEMICAL ANALYSIS
"- " = NOT ANALYZED

NS = NO SHEEN
SS = SLIGHT SHEEN
MS = MODERATE SHEEN
HS = HEAVY SHEEN

_____ 100
_____ 101
_____ 102
_____ 103
_____ 104
_____ 105

DEPTH TO BOTTOM OF BORING



TETRA TECH

Huntingdon

Engineering & Environmental, INC.

LOG OF MONITORING WELL INSTALLATION

PROJECT: RICHLAND COUNTY LANDFILL

WELL NO: SL-4

SHEET NO: 1 OF 2

JOB NO: 90-3092

LOCATION: 200' NORTH OF LANDFILL

DRILL TYPE: HSA

ELEV: MEASURED POINT 2011.63

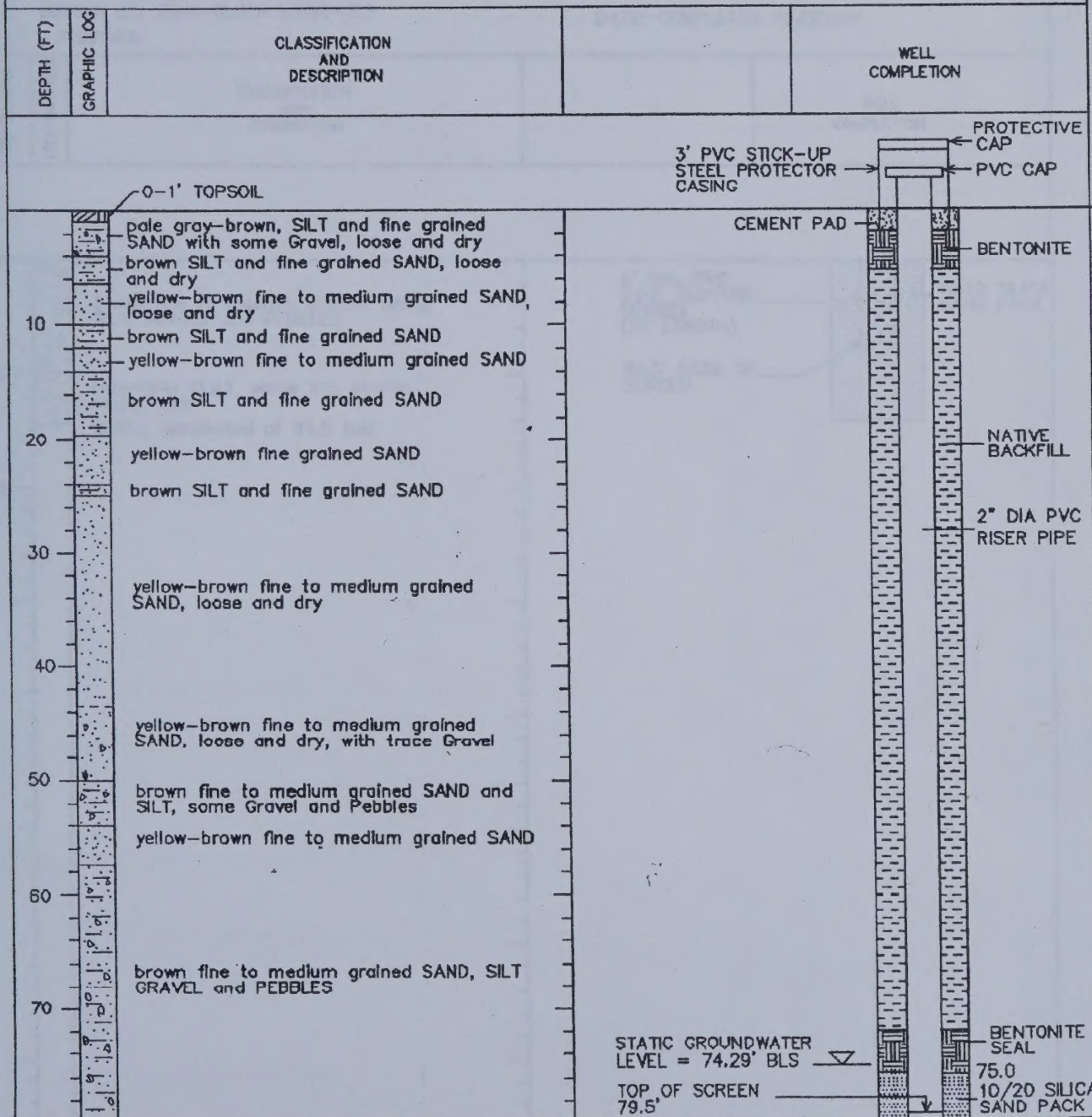
SURFACE 2008.6

DRILLED BY: HIH/BISMARCK

LOGGED BY: JOHN OLSON MWWC-319

DATE: COMPLETED 10/20/94

REMARKS:

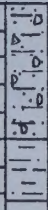
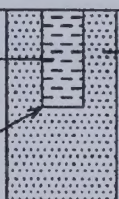


Huntingdon

Engineering & Environmental, INC.

LOG OF MONITORING WELL INSTALLATION

PROJECT: RICHLAND COUNTY LANDFILL		WELL NO: SL-4	
JOB NO: 90-3092		SHEET NO: 2 OF 2	
DRILL TYPE: HSA		LOCATION: 200' NORTH OF LANDFILL	
DRILLED BY: HIH/BISMARCK		ELEV: MEASURED POINT 2011.63	
LOGGED BY: JOHN OLSON MWWC-319		SURFACE 2008.5	
REMARKS:		DATE: COMPLETED 10/20/94	

DEPTH (FT)	GRAPHIC LOG	CLASSIFICATION AND DESCRIPTION	WELL COMPLETION
90		brown fine to medium grained SAND, SILT, GRAVEL and PEBBLES blue-gray CLAY, some Silt, plastic, sticky, firm Boring terminated at 94.5 feet	2" DIA, PVC 0.02" SLOTTED SCREEN (10' LENGTH) 89.5' BASE OF SCREEN 10.20 SILICA SAND PACK 

Huntingdon

Engineering & Environmental, INC.

LOG OF MONITORING WELL INSTALLATION

PROJECT: RICHLAND COUNTY LANDFILL

WELL NO: SL-5

JOB NO: 90-3092

SHEET NO: 1 OF 2

DRILL TYPE: HSA

LOCATION: 75' NORTH OF LANDFILL

DRILLED BY: HIH/BISMARCK

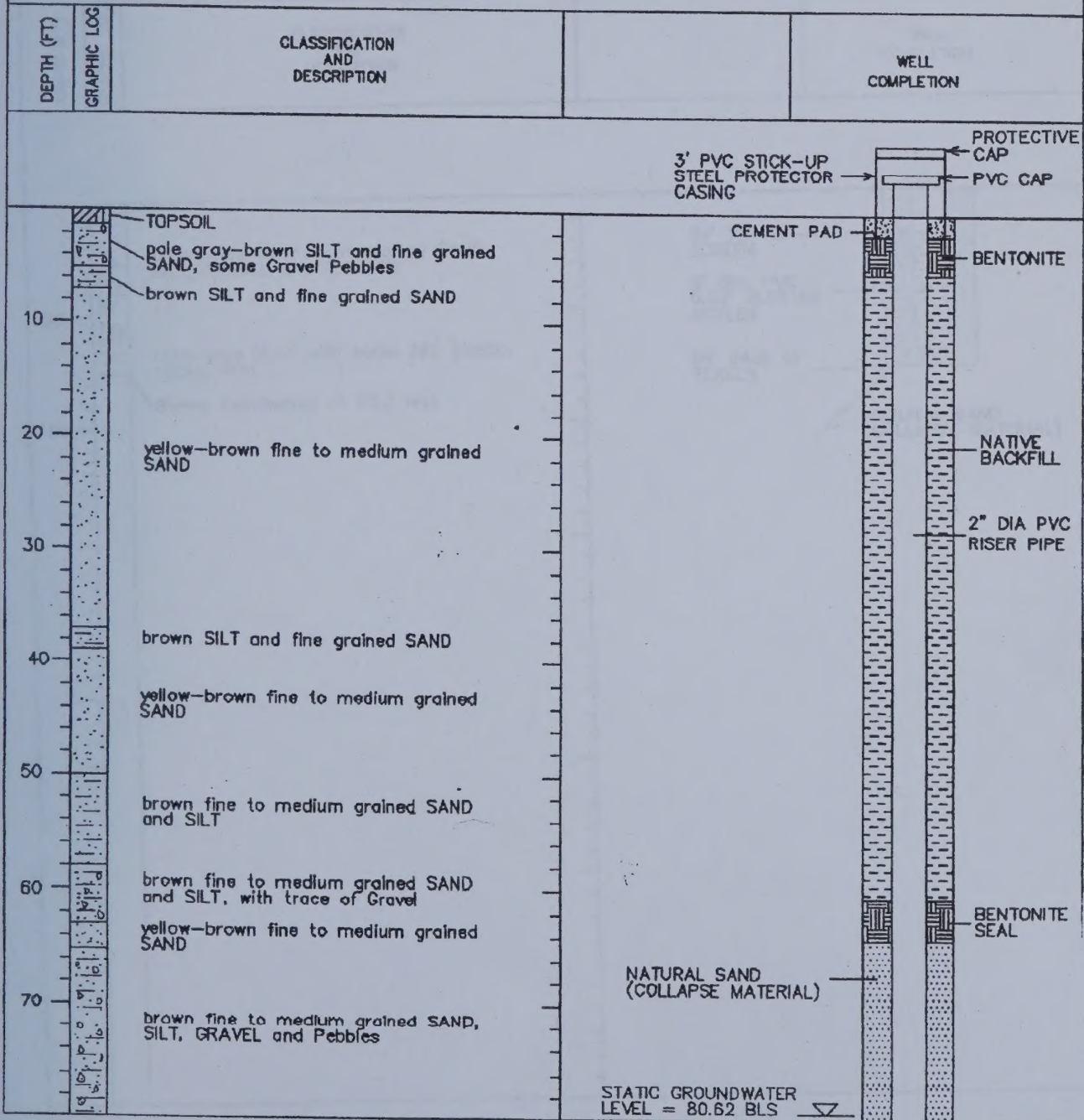
ELEV: MEASURED POINT 2018.06

LOGGED BY: JOHN OLSON MWWC-319

SURFACE 2015.10

REMARKS:

DATE: COMPLETED 10/20/94



Huntingdon

Engineering & Environmental, INC.

LOG OF MONITORING WELL INSTALLATION

PROJECT: RICHLAND COUNTY LANDFILL

WELL NO: SL-5

SHEET NO: 2 OF 2

JOB NO: 90-3092

LOCATION: 75' NORTH OF LANDFILL

DRILL TYPE: HSA

ELEV: MEASURED POINT 2018.06

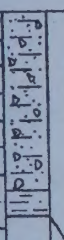
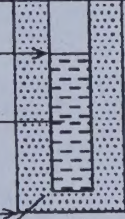
SURFACE 2015.10

DRILLED BY: HIH/BISMARCK

LOGGED BY: JOHN OLSON MWWC-319

DATE: COMPLETED 10/20/94

REMARKS:

DEPTH (FT)	GRAPHIC LOG	CLASSIFICATION AND DESCRIPTION	WELL COMPLETION
90		brown fine to medium grained SAND, SILT, GRAVEL and PEBBLES blue-gray CLAY with some Silt, plastic, sticky, firm Boring terminated at 95.0 feet	 84' TOP OF SCREEN 2" DIA. PVC 0.02" SLOTTED SCREEN 94' BASE OF SCREEN NATURAL SAND (COLLAPSE MATERIAL)

Huntingdon

Geological Survey of Pennsylvania

LOG OF MOUNTAIN VIEW RESTAURANT

DATE TIME BY CHECKED BY NO. OF SHEETS	NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS	NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS	NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS	NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS	NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS NO. OF SHEETS
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